Today's challenge

Current discussion around the challenges:

In this area can be divided into five categories: learning styles and culture, pedagogical e-learning, technology, technical training, and time management challenges.

1. Learning style and cultural challenges

Everyone has their own learning style along with their cultural influences; the ones who are taught using their own learning style and taking into consideration cultural aspects of individuals will perform better academically (Sywelem et al., 2012). To achieve the best learning outcome it is desirable to have an understanding of students' learning styles. Some students learn through interacting, some prefer learning through visual presentation, and some by listening to instructions and using written notes. This challenge has an implication on the learning outcomes and poses a serious issue for academics to understand the learning styles of their students in an e-learning environment

2. Pedagogical E-Learning challenges

Pedagogy is concerned with enabling the best way to achieve learning (Teo, 2006); if pedagogy is not considered then the desired learning outcome will not be achieved. Successful pedagogy requires the teacher to understand how students learn then design and deliver course materials, and mentor students appropriately, so that knowledge and skills are passed on.

3. Technological challenges

Technical challenge refers to development issues such as the bugs, the speed, the errors, functions and features not correctly working or do not work according to what academics require.

4. Technical training

Challenges training challenge refers to the training requirement that will enable academics to learn the e-learning features and functions correctly and to use them effectively. In reviewing e-learning literature, there are various criticisms of poor training provided by institutions to academics. Issues have been raised that include not enough training, inadequate training, training styles in use that do not fit academics personal preferences, lack of hands on practice, and also how to create materials according the pedagogical requirement was missing from the training scenario.

5.Time management challenges

Academics that use e-learning systems, face difficulties in managing their time. According to Reeder (2004) some of the "cyber culture values" are characterized by speed, reach and quick response.

Major challenge for the digital infrastructure

According to (NICI, 2015), energy access and high costs are a major impediment to Rwanda's industry and services sectors. The country has low per capita electricity consumption relative to the east African community with only 13% of the population having access to electricity, moreover with power outages. Electricity generation costs are high as well as the feed-in tariff of power that currently stands at 112 Rwf/kwh for households and Rwf 102/kwh for industries, despite GoR subsidizing the utility. Rwanda's electricity costs of $0.24/kwh, almost double that of its neighbors. 64% of businesses surveyed in the 2008 business investment climate survey cited access and cost of electricity as a major constraint. As Rwanda strives to increase electricity generation, ICTs can be leveraged to consolidate Rwanda's energy sources in order to enable sustainable energy generation, transmission and distribution through a smart electricity grid and energy market design.

1. **Limited Access to Finance**: lending for ICT companies is constrained by costs and risks arising from several factors, including: lack of adequate collateral, crowding out by government bonds, asymmetrical information (caused in part by limited private credit registries), and inadequate skills to assess and manage risk. Limited lending can also be attributed to Rwanda's low savings rate that currently stands at 8% of GDP. GoR should partner with financial institutions to establish special funding mechanisms to foster ICT industry growth.
2. **_Inadequate International Bandwidth_**: Rwanda still does not have sufficient international bandwidth. Being landlocked, the country is very dependent on neighboring countries for connectivity, which greatly increases connectivity costs. More importantly, given that ICT is a competitive industry, this dependence could compromise Rwanda's information security and business continuity. This can be remedied through other links to other sea cables such as those from southern Africa as well as satellite back up. Further, a virtual landing point can be established locally where telecommunication providers converge and acquire submarine capacity that can be distributed through their networks.

- **_Inadequate ICT Skills_**: Rwanda has insufficient skilled personnel in the ICT field to drive ICT development. As such, more ICT professionals will be trained and developed to increase Rwanda's ICT skills base.

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1. **_Low ICT Awareness And Usage:_** most Rwandans are still not aware of the available ICTs and their benefits. This is largely attributed to the lack of awareness, insufficient content relevant to the general population and limited rural ICT penetration. ICT in education, community development and public awareness initiatives will be implemented to increase ICT awareness among Rwandans.
2. **_Nascent Private Sector:_** Rwanda's private sector, particularly the ICT sector, is relatively small. It is mostly constrained by the high cost of accessing ICTs especially in rural areas, insufficient payment systems and a lack of innovation. Several initiatives will be implemented to foster ICT and ICT-enabled sector development including establishing a Technopole (an advanced ICT park), e-payment systems, a national access network to increase broadband penetration and internet affordability among others in order to foster both ICT and ICT-enabled sector growth.
3. **_Inadequate Information Security:_** Rwanda's cyber security needs to be reinforced to mitigate ever-increasing cyber threats. Cyber security awareness will need to be disseminated and public private institutional collaboration strengthened. Furthermore, a strong policy, legal and regulatory framework to ensure cyber security and compliance will be required.

- **_Limited interoperability of government systems:_** many government systems work in isolation of each other, which creates duplication and inefficient resource management. Most processes are to a large extent paper-based, which creates unnecessary delays. As such ICTs can be leveraged through e-government initiatives to further improve government operational effectiveness and efficiency, thereby improving service delivery to citizens.

NICI iii aims to address the above-mentioned challenges while improving Rwanda's ICT environment and accelerating services development.

Availability: Ensuring access by all citizens has been a mainstay of Rwanda's ICT policy, although there is still a substantial rural-urban gap, with the majority of mobile phones, landlines and internet access concentrated in Rwanda's capital Kigali. The national backbone is an IP/MPLS network, with a 10gbps capacity and 1gbps (upgradable) for each district. Currently, Rwanda has acquired international capacity equivalent to 2.5 GB connecting to the international routes however, this capacity is neither used properly nor accessed by all. A 2,500 km fiber optic backbone connecting all 30 districts of the country and 9 major border points; plus a Kigali metropolitan network connecting 3 districts and government offices, is already done, however the need to extend this network to all corners of the country is more apparent. By and large, the current networks: national backbone, Kigali metropolitan network and the wibro are located only within Kigali. This document does not constitute a government policy. It forms part of a presentation and should not reproduced without permission (Lima, 2012-2013).

Affordability: The greatest challenges that most developing countries are facing regarding bridging the digital gap is the affordability. Most of countries are market-led economies and correcting the market failures in ICT has been a problem to Rwanda as well. Most ICT tools especially equipment, are expensive for common people (Lima, 2012-2013).

Affordability	Rwanda	China
Fixed-telephone sub-basket ($ a month)	13.2	4.7
Mobile-cellular sub-basket ($ a month)	13.9	6.0
Fixed-broadband sub-basket ($ a month)	86.9	17.8

Source: The Little Data Book on Information and Communication Technology 2012(World Bank)

The ICT sector is facing a challenge of limited skillsets required for its sustainable growth. To date, in the framework of the national information and communication infrastructure (NICI) 2010 – 2015, some specific skills development projects have been designed to increase the number of specialized it-related industry, it project management and other set of skills required for the sector growth. However, these initiatives are still in early stages and have not yielded limited tangible results. Skills development remains at the heart of a sustainable knowledge-based economy. This challenge will continue to be addressed by the ministry of youth and ICT and all its partners during the next years. (Writer, 2013)

While there has been a surge of new range of business to citizens (B2C) services made mainly available by the telecom operators, banks and other ICT-enabled services, it has been noted that the rate of deployment of government to citizens (G2C) e-government services is generally done at a low pace and where available, systems and services not sufficiently used by the intended users. This translates into inefficient manual processes, delays in service delivery, long queues and bureaucracy, which in turn impose considerable burden to our economy. This challenge requires the development of a comprehensive e- government policy and strategy, which will be developed during the year 2013 but also an increased awareness of the existing online services.

ICT penetration, ICT awareness and literacy rate at community level remains at very low level. Generally, statistics show that citizens living in rural areas have a limited ownership of ICT devices, be it for computers, smartphones and TVs. This partially affects broadband uptake in the country. In addition, citizens (especially rural citizens) have a very limited awareness of how ICT can improve their productivity and socio-economic welfare. (writer, 2013)

The information and communication technology sector, including internet and broadband, has suffered from limited fixed-line infrastructure and high prices, but developments in the fixed network market are beginning to change this situation. (Gasore, 2019)

Barriers to Effective E-Learning

We can start to see how engineering education must change to adopt effective e-learning techniques.

A review of the literature found several lists of barriers to e-learning. Downey focused on the basics of cost of development and delivery, time to develop (including technological problems), and the lack of appropriate content. Dabbagh identified 1) issues surrounding course content, 2) technological assumptions, 3) logistical and implementation challenges, and 4) interfacing between face-to-face and on-line learning environments. Then the following barriers are identified and discussed:

 1) Course content issues,

2) Adoption rate of new technologies,

3) lack of technological standards,

4) Costs associated with development, and

5) Infrastructure requirements.

1. **Course content issues:** Most implementations of e-learning take the "adjunct" approach, where electronic means augment the classroom experience. This means making course materials available to students through electronic means. For example, instead of uploading the same or similar version of the class meeting schedule, build a database with a drop-down box so the student can select a particular class meeting date and see all relevant information concerning that class meeting (e.g., topics, readings, assignments, exercises, related links).
2. **Adoption rate:** Although many effective instructional technologies have been in use for years, getting the university to adopt the technology is often a stumbling block. Of course, getting down the learning curve to use the technology more transparently is often a barrier.
3. **Changing technology:** Effective e-learning is hindered by a lack of technological standards. Distance learning has evolved through several phases of major changes in technology, and each phase has required substantial capital investments. Web-based courses, on the other hand, have a uniform platform for delivery (the World Wide Web), and somewhat uniform content development tools (e.g., software from macromedia, adobe, and Microsoft). Professors involved with distance learning have had to roll with the changes as new technologies were introduced. For the professor who is used to delivering the same content the same way (in the classroom, using overheads and/or a blackboard), making the move to a web-based course or compressed video represents a major time investment.
4. **Cost:** Cardean University estimates that they will spend around $1 million for each course they develop. Even the best-funded universities would balk at spending this amount. That's why cardean was able to pull together some of the top names in business schools—individually, these schools could not afford to develop world-class on-line course materials. On the more local level, converting courses on-line or creating new on-line offerings requires new infrastructure, faster computers, new software, and the talent necessary to develop and support these new offerings.
5. **Infrastructure:** Many faculty wish to offer a portion of their courses in an e-learning format, but are stymied by their university's infrastructure. Each technology has specific requirements that must be met on the origination side. For example, if a faculty member wants to send streaming audio and/or video over the internet, he or she will need to choose a content creation software package. To be effective in e-learning, colleges and universities need to have the necessary infrastructure in place. This includes equipment such as highly reliable servers; support personnel available 24/7, not just 9 to 5; web designers; high speed networks; incentives for faculty to participate in e-learning; and shorter cycle times on curriculum change processes. As can be expected there are many challenges faced by academics regarding the use and success of e-learning in an academic environment.

Recommendations for better e-learning

According to Nurul Islam, m. B. (2015),he found that the recommendations for better learning are the following:

1. Match technology to infrastructure, professor, and learning goals

As with any system, balance is key. The technology must match the professor's abilities, needs, and learning objectives. The technology must also match the infrastructure of the organization offering e-learning.

Make sure that e-learning does not merely duplicate what is already being done, but rather that it integrates into the

learning experience and replaces some of what is traditionally done in the classroom (e.g., some discussions, distributing handouts, sharing related information).

2. Implement incentives to encourage use

Adoption rates among faculty vary. Faculty who are currently involved in e-learning generally do so for the following reasons: 1) they are early adopters of technology and like seeing how the new applications will work and possibly help them. 2) They are early in their careers and see e-learning eventually gaining a large "market share" of learning opportunities and therefore they want to get in on the technology early, before it's mandated. If e-learning is to come of age, appropriate rewards should guide behavior toward the use of e-learning. Even nonfinancial incentives can motivate use of e-learning. College academic platforms such as WebCT and ecollege.com offer the professor the ability to easily set up on-line courses (or companions to courses). The process of putting a file on-line so students can download it is very easy, as is allowing students to access their grades in a secure format. Professors do not need to learn html or ftp to perform these tasks in one of these environments.

3. Build toward the future

When dealing with technology in an academic environment, the time constants do not match. Let me explain: decision making for capital equipment in a university can often consume a four-month semester or longer. In this four-month timeframe, the technology being tought often changes by the time authorization to purchase is obtained. So, we must look to the future when proposing any e-learning initiative. One-gigahertz processing speed, wireless networks, handheld functionality, and other innovations will be old news in a year or two. "Looking to the future" means reading the literature and scanning the product marketplace to stay up-to-date on what's available now, what's in development, and what's scheduled for release..

4. Go outside the bureaucracy

As stated earlier, university decision making often lags behind the professor's need. And, systems selected may not meet the user's needs. So, take advantage of the internet's strength and go outside the bureaucracy to obtain what you need. Here's an example of one professor who did just that. This professor's university adopted WebCT as their e-learning platform. However, there were many problems in upgrading to the new version (e.g., students' names weren't being pulled in to the system, some features were not operational) that the systems were essentially ineffective. This professor signed up for a free trial at a competitor and was up and running with students accessing content, grades, and downloading course materials with very little development time or hassle. Student names and e-mail addresses were easily loaded in from the university-provided files. In short, don't wait for the bureaucracy to solve your problem; solve it yourself and save time, trouble, and delays.

5. Seek for constant feedback

With so many changes occurring in the e-learning environment, professors have many options. And, with these options come varying user experiences. Seek constant feedback from students on how well these features are working or not working and what features they would like added to the course. Networking with other professors and with vendors of e-learning technologies can be very helpful to gain visibility of what's available, how to access it, and what works best —at least in a particular application. Several national conferences are held each year to assist faculty and university staff in this endeavor. Only by staying ahead and keeping in touch with the latest applications can you make the most effective use of e-learning technologies.

Recommendation for institutions and students

- Institutions should provide the initial structure to a student's work, encourage self-direction and remain sensitive to the various learning styles.
- In this regard, the teacher should provide facilities that encourage learners to carry out research in order to 'discover' new knowledge through individualized initiatives and self-designed styles; individual or group tasks are guided by specific milestones.
- Students should construct their knowledge and solve problems as they view topics from multiple perspectives; they become autonomous managers of their learning and devise questions for which they seek answers from the World Wide Web (www). The learners, therefore, require the ability to not only self-search for knowledge from the www but also the skills to identify relevant knowledge for their specific purposes. Therefore the teachers' role in guidance and counselling of learners is important, as the www is a network of both appropriate and inappropriate content.
- Institutions must develop ICT support mechanisms to proficiently deliver media-intensive learning in an inexpensive way and to support daily e-learning facilitation for both teaching staff and students. It is essential to improve the digital literacy of the users and to enhance the utilization of Moodle (or other eLearning platforms) as a learning management system (Alexis Harerimana N. G., 2017).
- The cost of computing should be reduced sufficiently for schools in many countries to be able to afford networks of computers and display monitors.
- The computer manufacturers must provide 'educational 'generic software for schools and colleges 'bundled 'with the networks being purchased, mainly chosen for the wider software market in commerce and industry; that is, word processing, spreadsheets, data base software, and graphics applications, which mostly displaced the previous educational software being used.
- The complex design of the 'new' software environments required much more understanding of human–computer interfaces, curriculum potential, and the wider learning context.
- The internet must became accessible for all schools and colleges widening its access in education; for example,

all schools in Africa should be modernized in order to encourage them to connect to the internet, and access learning resources and use e-mail.

It was recognized that schools, colleges, and teachers needed to have much more training to take up and incorporate the use of e-learning in their teaching.

Conclusions

We discussed E-learning usage and implementation, identified challenges and made recommendations. There is a paucity of research on the use of social software for academic purposes in Africa as compared to developed world. We recommend the SS approach to promote learning activities that improve the learning process. According to the technology adoption model (talentlms, 2020) system adoption is influenced by attitudes, perceived ease-of-use, perceived usefulness and user behavioral intentions. Therefore, institutions should ensure that these factors are positive for the successful adoption of E-learning. In the future, we will survey instructor at tut and other SA institutions to measure the improvement in technology usage and also in Africa as continent. We will experiment with social software as a tool for learning to determine how it influences learning at SA institutions.

In brief, regarding to the benefits of e-learning and it like development of the country in all sectors such education, business, health etc. Even though there is invention of e-learning and it in Africa as whole continent, it's not yet on sufficient due to different obstacles include poor digital infrastructures (poor connectivity, lack of computer and other related electronic devices), which hinders the development of Rwanda and Africa in general .

Therefore governments should invest a certain percentage of country's budget in this sector to increase the knowledge based economy.