

The Case of Learning by Doing and its Applications in Tanzania

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Abstract

The Communication System Design (CSD) Course offered at the Royal Institute of Technology (KTH) in Sweden is a problem oriented, project-driven environment integrating development and learning. It is a framework for learning by solving real world problems involving Master students from various fields of specialization, mentored and supervised by their teachers and industrial experts.

CSD is based on integration of Research, Education and Innovation, Problem-oriented, project-driven learning, peer learning and vicarious learning where diverse teams of students work in relay projects with handover procedures.

The paper presents a case study on project based model of learning (learning by doing) that was used to implement a very big local area network Bunda and Serengeti Districts in Tanzania. The actual implementation involved teams of students from KTH working together with local employees.

Keywords

Education, Innovation, Problem-oriented, project-driven learning, peer learning, vicarious learning.

1. Introduction

This section will highlight the methodology of this study as well as provide an overview of the Communication System Design (CSD) course at the Royal Institute of Technology (KTH) in Sweden.

1.1 Methodology

The case study is based on the experience of the author while participating in the CSD course in various roles: from being a student to project owner. But also, the case study is based on the experience of the author as a project manager during the implementation process.

1.2 Overview of CSD Course

The Communication Systems Design Course at KTH (CSD, 2013) is a framework for learning where teams of senior MSc and PhD students, faculty members, consulting experts and a wide spectrum of stakeholders, work together, using leading edge technologies, to solve real world problems.

1.2.1 Project Finding

The projects are requested and sponsored by external project owners and the project portfolio includes projects from industry, including private and public sector companies, public administration, civil society and organizations for international development cooperation.

1.2.2 Team Formation

Students are recruited from different education programmes and universities, by their competence, in order to provide the projects with the best possible staffing. Since this course run for a full semester (20 credits), students are allowed to register for either the full credit which implies a no other courses allowed or register for half or quarter of their time. The number of credits taken s measured in terms of amount of work (hours) the student input per week.

The kickoff start by all teams assembling together where the teaching provide general lectures related to how the course is run. Sometimes they do invite experts to provide technical lectures depending on the nature of the identified projects.

In addition to team building activities, the first week in the course is spent by meeting the project owners to get clarifications where necessary on their assigned projects.

1.2.3 Coaching and Grading

Coaching is done by senior student who have passed this course, PhD students or sometimes lecturers. The coaches are tasked in meeting the teams weekly to provide feedback as well as guidance.

On the grading, the teaching team does provide the final credits based on inputs from the coach and team members.

1.2.4 Some Previous Projects under CSD

A few project examples performed through the CSD course in Africa include:

1. University of Malawi Blantyre Campus network
2. Internet exchange points in Mozambique, Rwanda, Namibia, Malawi, Zambia and Burundi.

3. Rwednet-Kigali 1Gbps city network ring
4. EkoKonnnect university network
5. SomaliREN city rings and national infrastructure in Somalia.
6. Carenet infrastructure supporting outpatients in Stockholm
7. Solar-driven, open source based PC-router

1.2.5 Taking CSD to the World

Due to the success of CSD course, there is an initiative for project based learning that will involve other Universities throughout the world. The Technology Transfer Alliance - TTA (TTA, 2013) is an association of Research and Higher Education Institutions promoting, and supporting each other in their strategic role to contribute to the development of the societies in which they exist by providing opportunities for their researchers, teachers and students to engage in strategic projects for academic credit. The first meeting and workshop for TTA association was held in February 2013 in Tanzania.

2. Background

In this section we discuss the genesis of ICT for Rural Development (ICT4RD) project in Tanzania.

1.2 Initial work with DIT

In 2004, Swedish International Development Agency - SIDA (SIDA, 2013) funded the design and installation of Dar Es Salaam Institute of Technology (DIT) Campus Network in Tanzania where KTH was requested to assist via CSD. The CSD team which was formed for the task consist of two KTH students and four DIT ICT technicians. The resulting project, known as “DIT Campus Network” (Ufumbuzi, 2004) was tasked to establish a core campus network with the following basic services;

- Implementing basic Internet network and application services, including DNS,
- DHCP, Dial-up, E-mail and Web
- To connect DIT to the Internet via satellite
- Training of system administrators and the users
- Connecting to the Tanzania Internet Exchange (TIX)

1.3 Genesis of ICT4RD

August 2002, Nils Jensen arrived in Tanzania to work for SIDA as their Programme Officer in the ICT area (Sawe & Nungu, 2009). This was a pilot post, which hopefully could lead towards replication in other developing countries.

Tanzania was chosen as pilot country because of prior SIDA-funded ICT initiatives in Tanzania such as the ICT policy and the establishment of courses for IT technicians at Dar es Salaam Institute for Technology (DIT), also known as *IT Fundis training*. The question at hand was what

to do next to lessen the digital divide in Tanzania? Where and how should SIDA invest to help get rid of this nasty divide once and for all? Who could be the most ideal partners in doing so?

Mobile telephony had already given us proof by then that all of us benefit from information and communications services. The challenge was then to identify and provide solutions that could deliver such services at a cost that would be affordable for most Tanzanians. Technological solutions alone would not suffice for that goal. Other critical factors included having shared resources, access to technical support, training of technical people, user training, skilled management of implementation and operations and, not least, awareness among the decision makers in both the Central Government and the Local Authorities, as well as among the actors and all other stakeholders.

Discussions were held with people at DIT, COSTECH (Tanzania Commission for Science and Technology) and KTH which resulted in a co-operation agreement among the 3 institutions for a programme that should provide a model for rural ICT. The focus was to implement that model as a demonstrator for others to learn from, and as a proof of its viability. This model should therefore cover all the critical factors required for beneficial and sustainable solutions.

1.4 Goals and Objectives of ICT4RD

Thus, ICT for Rural Development (ICT4RD), a Research and Development project in Tanzania was conceived in 2005 to be implemented via the CSD framework. In achieving its purpose of designing and validating a strategy for how to establish sustainable broadband markets in rural Tanzania, ICT4RD established two pilot sites of Wami in Coastal Region and Serengeti in Mara Region.

The pilot sites was used to used in testing different infrastructures and business models for operating the networks and providing the services in a sustainable way. On the infrastructure side, the project used existing infrastructures (optic fibre, wireless, microwave links etc) wherever possible to avoid costs of constructing new ones. The focus of the project was on business development in basic public services, such as education, health, local government and support to rural entrepreneurs.

In addition to the pilots, there was capacity build embedded in the project where one PhD and eight Masters of Science have been funded.

3. Literature Review

This section discusses other initiatives of Project-based and Problem oriented learning.

3.1 Learning by Doing Centres

Proacademia is a Unit of entrepreneurship at Tampere University of Applied Sciences in Finland. Proacademia combine business and ICT students into teams of 15 to 20 students, forming companies which do real business and pay taxes. The students do join the academy after their first year in school. Unlike CSD course, this is a bachelor degree course with duration of 3.5

years. Grading is embedded within their daily activities performing for the company.

Tiimiacademia is an entrepreneurship centre of excellence at the JAMK University of Applied Sciences in Finland where students run their own cooperative businesses and learn with real money and real customers (Tiimiakatemia, 2013). It is a bachelor degree course with duration of 3.5 years. Unlike CSD where students form teams in their first year, Tiimiacademia students join the Center straight away from year one. Another difference is that participants are either attending entrepreneurship or business studies only. Grading is embedded within their daily activities performing for the company.

3.2 Project-driven Learning

The Aalto Global Impact course (Aalto, 2013) is run similar to CSD course where students from Arts, Technology and Architecture form teams in their final years to solve real life problems.

4. ICT4RD Implementation

The goals of ICT4RD project was to support the ongoing U.N. Millennium Goals (eHealth, eSchool and eGovernment) activities in rural areas by contributing to the establishment of Internet access at schools, health centers and village administrations along two identified fibers.

Project Teams under CSD

The work was executed in phases.

4.1.1 Feasibility Phase

The first team of five members, two KTH student and three Tanzanians (employees from DIT, COSTECH and Juasun) was sent down in Tanzania in 2005 with two major goals as follows: 1) Drafting a long term programme for enhanced use and benefit of ICT in rural areas of Tanzania. 2) Designing and deploying a demo Voice over IP (VoIP) system as a technology that can make communication more affordable and as an example business case for private actors (Bwamkuu, 2005).

4.1.2 Infrastructure, Policies and Procurement Phase

Building on the reports from the previous work, two teams went again in 2006. The first team of four KTH students and one DIT employee (Genesis, 2006) had specific goals of connecting a few public facilities to the Internet using existing infrastructure and develop a last-mile solution for connectivity. [Detailed goals were:](#)

- A feasibility study on which technology(s) can best serve as a last mile solution to provide broadband services in the rural areas of Tanzania.
- Based on the study, provide a network design.

- Implement the design and connect at least one rural health center, one district hospital, one school and one local administration to the fiber.
- Deploy application demonstrators, e.g. telemedicine, distance learning and e-government.
- Provide a cost template for fiber deployment in different kinds of power lines in Tanzania.

The second team (Issakson, 2006) was composed by three MSc students from KTH, one PhD candidates from Karlstad University and another PhD candidate from Reserach Policy Institute at Lund University. The goal for the second team was to create a benchmarking model for development of sustainable broadband in rural areas.

4.1.3 Services Provisioning Phase.

Four teams were formed in 2007 focusing on establishing services and capacity building. Three of the teams have MSc students from KTH while the 4th one has two KTH students and three DIT employees. Their goals and/or services included:

- Installing Care2x (an Integrated Hospital Management Information system), Ipath (the discussion Forum for medical professionals), Moodle (the Course Management systems, and an Interactive platform which consist of email and instant messaging, voice and video services).
- Establishing the Chalinze-Miono ICT pilot project together with selected users and other stakeholders to provide a business development environment for rural broadband access that can be used for problem-oriented project-driven capacity building.
- Customizing existing course management software to provide an eLearning environment that will facilitate teaching and learning at secondary schools in Tanzania

4.1.4 Trainings and Services Refinement Phase

Other student projects in terms of CSD course as well as Master Thesis followed in 2008, 2009 and 2010 related to capacity building, studying the impact on the ground and designing a low power, low cost router (supporting gigabyte ethernet and fiber) that is currently running on site. This router has a power module that enables it to run on a variety of power sources including main supply and battery.

4.2 MSc. Thesis work

Master thesis work was also performed in the implementation process as a continuation, building on where CSD students have left. Most of these students had worked earlier in CSD teams before finding a thesis problem to work on. Some of the major thesis works in the context of ICT4RD project includes the titles such as:

1. Open Access ICT Infrastructure in Rural Tanzania (Isamuyo, 2006)
2. Broadband Services and Applications for Rural Areas (Genesis, 2007)
3. End users Capacity Building, Supporting, Network Management and Security Implementation (Kitindi, 2008).
4. E-Business Solution for Micro-finance Institutions in Tanzania (James, 2008)
5. Commercializing the broadband services provisioning in Rural Tanzania; a case study of Wami Broadband project (Bwamkuu, 2009).
6. Facilitating e-government by promoting use of broadband services in rural areas: a case of Bunda and Serengeti, Tanzania (Mujwauzi, 2009).
7. Theoretical and applied eLearning in Tanzania (Malmqvist, 2008).
8. Capacity Building of ICT in Education for Rural Areas – A case study of Lugoba Secondary School in Tanzania (Mbwana, 2010).
9. Broadband Islands: How can network services improve communication efficiency, increase awareness of ICT and create incentives to further develop ICT infrastructure with the use of local services? (Camfeld & Tong, 2010).
10. Potentials and challenges in the provisioning of broadband services in Serengeti (Holmgren, 2011).

4.3 ICT Interns

The Swedish Program for ICT in Developing Regions (SPIDER) run a program known as Junior ICT Experts aiming at placing ICT graduates from Swedish universities at Spider-supported organizations in partner countries (Bolivia, Cambodia, Kenya, Rwanda, Tanzania, and Uganda). The Internship program (SPIDER, 2013), range between six and eighteen months.

During services provisioning phase of ICT4RD project, two ICT interns sponsored by SPIDER worked in the Serengeti Broadband Network in the area of capacity building to local staffs as well as supporting daily operations.

The network is still used even today by students from local training institutions, including DIT for their Industrial Practical Trainings.

5. Conclusion and Recommendations

5.1 Conclusion

The case study is meant to share experience on how to achieve learning and research through the project-driven, problem solving framework. The paper discussed the framework in brief, with a specific reference to the Communication Systems Design (CSD) course at KTH in Sweden. The framework discussion was followed by a discussion on how this framework was implemented in Tanzania, building teams from various programs at KTH as well as local employees.

5.2 Recommendations

Based on the experience gained through the execution of ICT4RD project in Tanzania via the CSD (now TTA) framework, we are recommending the same model to be adapted and/or extended to other higher learning institutions. Notable benefits for this type of learning include:

1. Students gaining working experience in real life projects while doing their studies
2. Lecturers do research while supervising the students at the same time during the course offering.
3. The community benefit from the innovative minds of the students.
4. It is a co-creation process where the communities are involved in providing the solutions.
5. Projects are accomplished with a fractional of the total costs compared to the case where commercial firms are used.

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Biography

Amos Nungu is the Head at the Center of Excellence in ICT and a Lecturer at Dar Es Salaam Institute of Technology (DIT) in Tanzania. He holds a PhD and MSc. degrees in telecommunication systems from the Royal Institutes of Technology (KTH). His research interests include methods for establishment of sustainable broadband markets in under-served areas, both technical as well as non-technical issues.