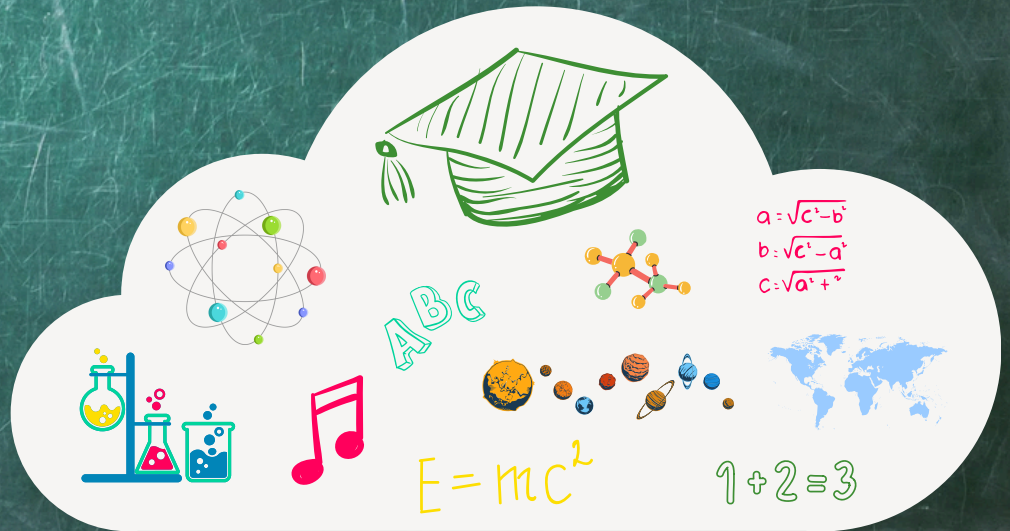


MICRO-CLOUDS FOR EDUCATION:

A solution for rural offline e-learning in developing countries?



By Ephraim Daka
Research and Innovation Expert



Abstract

According to UN data, the global rural population is about 3.4 billion and is expected to rise further. In developing countries, rural and remote learners tend to be disadvantaged with regard to e-learning opportunities due to infrastructure limitations – mostly from limited or non-internet connectivity. Without adequate connectivity, distant rural learners still lack common learning materials intended to teach them how to engage in an information and communications technology (ICT) – intensive world. This paper explores the digital divide that results in these rural developing countries' education

environments and proposes the potential solution of micro-clouds for education as an innovative solution to facilitate e-learning in rural areas. This solution provides a bridge for digitally unconnected students and society to join the global ICT community and compete effectively. The paper calls on governments and educators to take an overall systems approach to conquer the digital divide that embraces the rural populations worldwide regarding infrastructure, economics, and skills development in rural regions.

Digital Divide

The problem of unequal access to education persists in the digital age, and the situation in developing countries urgently needs solutions. For example, while the number of people connecting to the Internet worldwide is increasing, according to the International Telecommunication Union (ITU) over 1/3 of the world's population has never been on the internet. Further, the research shows that 96% of those that; without an internet experience are in developing nations.



Fig. 1 - Rural School in Malagasy

Long-term, we need to address the growing inequity faced by learners, teachers, and institutions in global rural areas through sustainable internet infrastructure, as rural and remote teachers and students have several urgent constraints that need to be addressed to provide access to suitable ICT-enhanced teaching and learning platforms long-term. However, in the short-term, we must protect against the widening of the digital divide by finding innovative solutions that bring inclusiveness by taking advantage of innovations in e-learning within digital learning that can offer immediate access to

those that are unconnected, while we work on the difficult, long-term infrastructure issues.

Exploring solutions/ requirements

To leverage ICTs for enhanced education in global rural regions, learners and institutions need to consider solutions that provide a connection to defeat isolation. Another challenge is that since most of these scenarios are in developing regions, the ICT infrastructure must be inexpensive to acquire and maintain and relatively simple to operate. In this case, cloud-based solutions are most suitable, if they can be made to work independently of constant internet connectivity.

Regarding delivering e-learning capabilities in rural or remote and isolated contexts, several studies (Raspopovic, Cvetanovic, & Jankulovic, 2016) show that isolated networks in silos can effectively enable e-learning - like courses (Conlan, Dagger, & Wade, 2005). Therefore, ICT is expected to expand network coverage to rural areas and make affordable Internet available to all to be able to tap into those courses.

Conquering the digital divide

An alternative infrastructure solution has emerged which offers a way forward towards closing the digital divide as it blends a cloud-based solution with local technology to insulate against the lack of connectivity. Ultimately, this seems to offer a faster path to address issues of constrained economics, hardware provisioning, multi-hardware

While the number of people connecting to the Internet worldwide is increasing, according to the International Telecommunication Union (ITU) over 1/3 of the world's population has never been on the internet.

compatibility dynamics, and integration through inclusivity with the rural population. It's an approach that can use a local point of education content in the school (a "micro-cloud") that can be addressed using any WiFi and browser-enabled devices, such as a tablet or smartphone. Today, both young and older adults in rural areas with access to primary education are more than likely to use mobile internet technologies such as phones within their household. Both the familiarity with and access to these devices can be key drivers of adoption within their family units and the community as a whole.

The micro-clouds for education as a solution for e-learning

Micro-clouds for education provide an excellent base to develop the means of delivering e-learning capabilities including content, rich media, and best-in-class lessons that do not require constant access to the internet. Distinguished ministries of education should consider working towards implementing cloud-based platforms to enhance e-learning while coupling these initiatives with micro-clouds for education for their most disconnected rural populations.

With this solution, students and teachers across the region have access to cloud-based learning management systems, curricula, content, and resources – even when the school has no connectivity or power.

In a micro-cloud-enabled scenario, the learning infrastructure, as well as the curriculum, content, and resources, are staged on the micro-cloud platform in the school (usually a very small device).

Students connect on a local Wi-Fi (offered by the micro-cloud) that appears to be an internet connection, hence the ability to use a cloud-based e-Learning paradigm even if there is no internet connection or even without power. Valuable incremental resources (such as YouTube videos, simulations, interactive maps, learning games, educational apps, Wikipedia content, etc.) are housed locally in the micro-cloud.

Most importantly, hundreds of micro-clouds throughout the region/country can be managed and administered from a single, centralized point. The administration of the Ministry of Education can curate a uniform curriculum and content, which is then populated to the micro-clouds whenever a sporadic connection becomes available

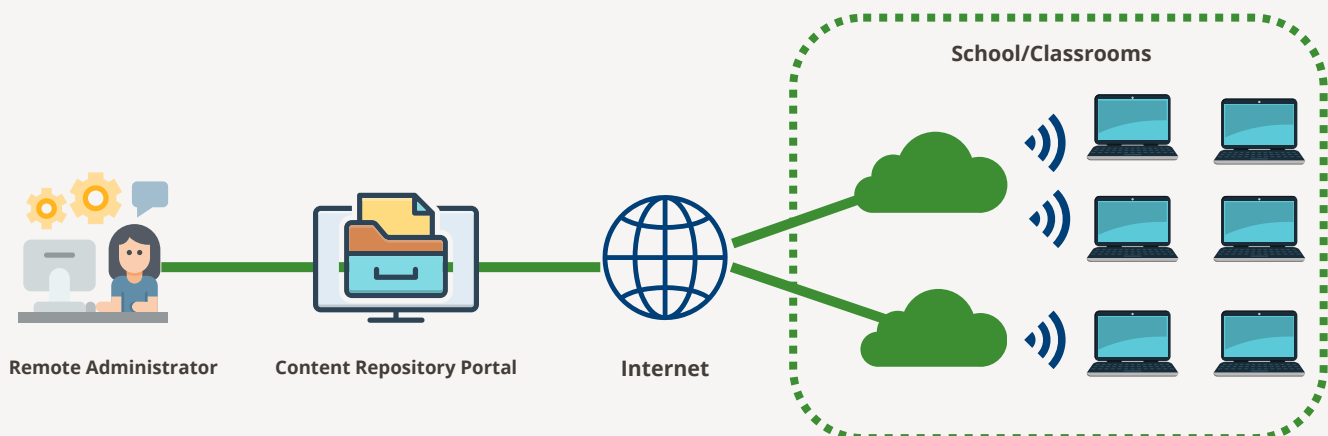


Fig 2: Micro-Cloud for education architecture

Conclusions

ICT-related social and economic opportunities are rife in developing countries. Based on past projects in Africa, it is possible to observe that these issues often directly affect the livelihoods of low-income and low-skilled people and families. For example, in a rural setting, micro-entrepreneurs selling merchandise and using electronic gadgets accumulate significant social and economic activities locally and are vital users of continental ICT infrastructure. However, the technical reality of the local ICT ecosystem in rural environments, from my point of view, hardly provided satisfactory services to local users, educators, and entrepreneurs.

Typically, my fieldwork-related activities within ICT began with performing a mapping of the local ICT landscape or ecosystems. The result of doing this was to pave the way for formulating interventions, but for sure, it was radically different from developed countries and something quite expected.

Furthermore, some of our findings, in general, were that the local technical infrastructure had challenges in serving mobile telephony coverage and bandwidth, limiting users' ability to access Internet-based services.

Equally, the scarcity of devices and price thresholds also contributed to poor access to ICT services. Another critical factor was that the lack of electricity supply presented a severe challenge from several fronts. Today, however, solar energy has emerged as a suitable source of electricity for most people living in rural areas and off the national electricity grid.

For example, ICT skills are now commonly taught via ICT-enhanced learning. Micro-Clouds for education offer solutions for several stages of ICT capacity building.

.Notably, the unconnected population also lacks access, especially in a world where learning is increasingly being delivered online with the assumption that everyone has a stable and high-capacity internet connection which is not the case.

The need to enable the most isolated and unconnected global rural community to join the connected world of the twenty-first century is considered essential.

The proposed solution outlined in this paper provides detailed information about the platform and toolset for the remote or rural population, especially students. To engage learning via twenty-first-century e-learning technologies, we consider the micro-clouds for education to equip global rural learners and educators to participate in an increasingly ICT-intensive world.

By taking advantage of such innovative ICT infrastructure that enhances equality and fundamental rights to acquire knowledge.

References/Bibliography

Conlan, O., Dagger, D., & Wade, V. (2005). eLearning Without Borders – A Support Framework for Reusing Educational Strategies. Retrieved 7 26, 2022, from <http://tara.tcd.ie/handle/2262/22599>

Raspopovic, M., Cvetanovic, S., & Jankulovic, A. (2016). Challenges of Transitioning to e-learning System with Learning Objects Capabilities. *The International Review of Research in Open and Distributed Learning*, 17(1), 123-147. Retrieved 7 26, 2022, from <http://irrod.org/index.php/irrod/article/view/2172>

Teo, T. S., & Tan, M. (1998). An empirical study of adopters and non-adopters of the Internet in Singapore. *Information & Management*, 34(6), 339-345. Retrieved 8 19, 2022, from <https://sciedirect.com/science/article/abs/pii/S0378720698000688>

About the author:

Ephraim Daka has working knowledge in articulating concepts and ideas with a clear purpose to influence concrete results. He is certified in Innovation - 360 Framework, expertise in Assessing & Measuring Innovation Capability. Also have extensive expertise in implementing – Education - Industry-Government & Society collaboration programs and high proficiency in conducting feasibility studies in Rural economics, Environment & Agriculture Value-Chains.

The expert's experience in the ICT sector comes from his work and engagement in research projects such as the Euro-Africa ICT research collaboration and policy projects with several components of interventions in Africa. Much of the work involved analyses how ICT can create livelihood opportunities, and what its impact or contribution can help socio-economic development. In addition, has helped to develop forward-looking perspectives to enhance how ICT can accompany inclusive innovation practices that effectively address rural and urban poverty.

