Journal of Learning for Development 11(2), 2024, 304-310.

Exploring Offline e-Learning for Resilience: A Case Study

Tony John Mays and Ricky Zhiyong Cheng

Commonwealth of Learning, Burnaby, Canada

Keywords

offline e-learning, Commonwealth of Learning (COL), Aptus

Abstract

There are too few teachers and schools to meet the need for quality universal basic education. Therefore, alternative approaches to education provision need to be explored, such as open and distance learning methods and development and provision of curriculum-based Open Educational Resources (OER). However, distribution of printed materials is increasingly costly, and distribution of digital resources remains a challenge in areas with little or no connectivity. This case study explores the potential of using offline strategies to share digital OER. It suggests it is possible to provide access to digital learning resources even in the most remote areas by using appropriate technology, like the Commonwealth of Learning's Aptus device.

Introduction

The world has 85 million teachers but is short of 69 million teachers, mostly in Sub-Saharan Africa, for Universal Basic Education to be possible (UNESCO, 2022). However, Education Finance Watch 2023 indicates that while there has been some positive increase in spending on education, it is not sufficient to make up the shortfall in needs (World Bank et al., 2023). Therefore, alternative approaches to education provision should be explored, such as open and distance learning methods and development and provision of curriculum-based Open Educational Resources (OER).

The Commonwealth of Learning (COL) was established in 1987 by Commonwealth Heads of Government *"*... to create and widen access to opportunities for learning, making use of the potential offered by distance education and by the application of communication technologies to education*"* (Memorandum of Understanding on the Commonwealth of Learning, 1988, amended 1995, 2014). While acknowledging the growing trend towards blended and online provision, COL has always recognised the need also to make provision for learners and teachers with limited technology and/or connectivity, recognising a digital divide that seems unlikely to be bridged anytime soon (GEM, 2023). However, distribution of printed materials is increasingly costly, and distribution of digital resources remains a challenge in areas with little or no connectivity (COL, 2020; Rasmussen, et al., 2014).

This case study, therefore, explores the potential of using offline technology to share digital OER with both teachers and learners. Various initiatives have experimented in various ways with how to design and deploy such technology (for example, World Possible [u.d.], report significant deployment of another offline access device called RACHEL). However, despite several pilots, we still know relatively little about what offline technology to use in what contexts and in what ways.

For example, Rao (2014) reported that several emerging offerings had integrated a range of technologies for the mobile-enabled classroom — such as processors, projectors, routers and

solar energy panels. These included SK Telecom from South Korea, which offered a range of 'appcessories' such as the SmartBeam pocket projector, a smartphone-based robot and WiFi Audio. A team from Ireland also developed 'School in a Box', which included a solar-powered iPad and battery pack for emerging economies with unreliable electricity grids. The MillenniumEdu consortium also rolled out 'ruggedised' laptops and tablets with educational content and the Commonwealth of Learning (COL) introduced Aptus (Rao, 2014).

This paper focuses on the latter example as there remains great interest in the use of offline devices to share digital content (Maro et al., 2023; Woodward, 2022) but limited actual deployment. However, Aptus has a history of deployment in the field as an offline device for this purpose.

Aptus

COL observed that the price of mobile devices had come down significantly over the years, while their computing power and memory had increased. Many countries had launched tablet distribution projects to equip teachers and learners with access to web-based learning materials through these low-cost devices. However, many of them across the Commonwealth and the globe still struggled in 'unconnected' environments. Although innovations in open and distance learning continued to make education more accessible, this development highlighted a significant barrier: limited, or lack of, access to the internet still restricted teachers and learners from using digital OER. Starting in 2013, COL designed and developed a different approach to extend support by repurposing available commercial products to address this barrier.

The result of this innovation was COL's Aptus, which is a low-cost mobile device that allows educators and learners to connect to digital learning platforms and content without the need for grid electricity or internet access. This mini-PC requires only battery power, which can be recharged via grid power or solar charger as needed. It can host up to 128GB of educational content and facilitate interactive, virtual learning anywhere — whether in a remote rural village or on a vast university campus. The result was a 'Classroom Without Walls' that could be set up within minutes and accessed by any learner with a laptop, tablet or other mobile device.

The design and functionality of Aptus continued to evolve based on research, field trials and the deployment of about 1,300 devices in twenty-eight countries, and saw five product generations between 2013 and 2016. The latest iteration is based on Raspberry Pi (COL, 2021) as illustrated in Figure 1. This iteration opens the possibility of scalable provision with Ministries and institutions able to purchase, set up, and deploy their own devices.

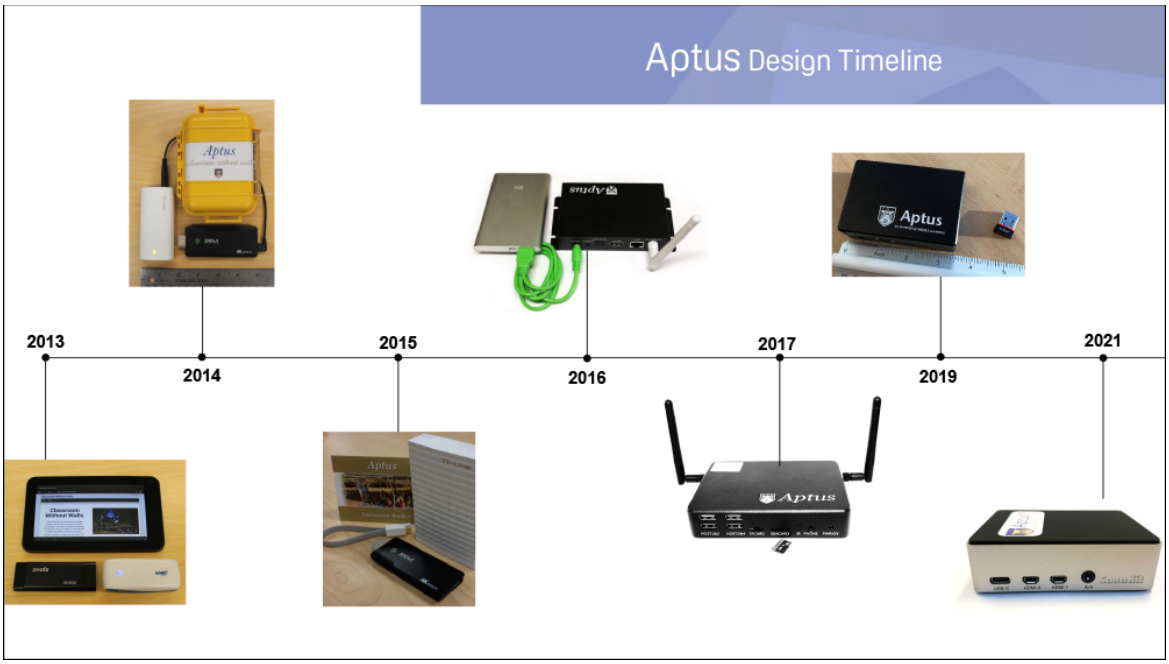

Figure 1: Aptus design timeline (COL, 2021)

Methods

Although use of the Aptus has been reported in various studies and reports, the information provided previously tends to be limited in scope and a clear picture of the overall deployment of this technology has not yet emerged. An interpretive case study approach was employed as an appropriate strategy for a focused investigation of deployment of a single example of an education technology within multiple education contexts (Rashid et al., 2019; Sjoberg et al., 2020). The case study approach presents an opportunity to draw together information from different sources related to the same central phenomenon, in this case the Commonwealth of Learning (COL)'s Aptus technology. Therefore, a search was undertaken using COL's open access repository and online search engines to identify and draw together studies and reports related to the device, information which, otherwise, was previously widely disaggregated.

Results and Discussion

Aptus Deployment

As noted, Aptus/AptusPi has been deployed in different ways in twenty-eight countries. Some examples are explored below.

In India, Aptus was deployed to provide access to learning content for rural women and their families in a semi-arid region with a tele-density average of less than one-fifth of India's average at that time (Mann Deshi Foundation, 2017).

In Pakistan, Ally et al. (2017) observed that students used tablet computers to access electronic learning materials from the Aptus local server without having to connect to the internet. The project was implemented in a school in Pakistan. A total of 74 Grade 8, 9, and 10 students were involved in this project. The research revealed a positive impact on students and on learning because of their participation in the mobile learning project: students were better able to use the mobile technology for learning. Both students and parents also indicated that the

project increased the students' knowledge on the use of tablets for learning. Parents indicated that the mobile learning project increased their children's interest in studying. Teachers also acknowledged that the students took more interest in classroom learning and concentrated on their tablets during study. Students were tested before and after they were supplied with content on their tablets. The post-test scores were significantly higher than the pre-test scores, indicating the use of the tablets for learning improved students' performance.

In Samoa, Mow et al. (2017) trialed the Aptus device within the National University of Samoa. The goals of the research project related to this deployment were to explore the acceptance of using the Aptus to access e-resources within the context of education in Samoa, with user acceptance measured by evaluating the ease of use and usefulness of the Aptus. The findings of the trial indicated very positive perceptions by students and teachers at the university in terms of ease of use and usefulness of the Aptus within educational settings. The study also recommended training teachers on the use of the Aptus and its applications, such as Moodle. There were similar findings from a subsequent deployment of Aptus in primary schools in Samoa (Mow et al., 2019).

Aptus/AptusPi in Open Schooling

Aptus technology has also been extensively used in COL's Open Schooling initiative. Towards the end of its previous strategic planning period, COL sought to evaluate the impact of its interventions in open and innovative schooling (OIS) in the period 2018-2021 through an external review. An online quantitative study was carried out in Belize, Malawi, Mozambique, Trinidad and Tobago, and Zambia, followed by a contextual cost-benefit analysis, and a social return on investment (SROI) analysis. Overall, the project was found to have a significant social return on investment and both directly (through student connection to OER shared on the Aptus or AptusPi device) and indirectly (through teachers accessing and then re-using the content with their learners during contact sessions) reached significant numbers of learners (COL, 2021).

In Mozambique, one of the countries involved in the OIS model, it is not unusual to find a school supporting multiple cohorts, for example morning and afternoon day scholars and evening, weekend and/or 'holiday' cohorts. This provides a possible way to reach more learners using the same physical infrastructure in a blended way. It is necessary then to work out what is best managed in a face-to-face contact session and what could be learned independently through access to curriculum-aligned OER. Some learners might be able to access and download such OER by visiting a connected school or other learning support centre, but the question still arises how to avail access in schools and centres which are not yet connected. Aptus remains a solution for such contexts although, as noted in studies from both Mozambique and Zambia, access to devices (including mobile devices for learners and teachers), ongoing teacher development and support and expansion and renewal of curriculum content are all critical to scaling (Chuulu et al., 2023; Cossa et al., 2021).

Belize also recently piloted use of the AptusPi device, for two subjects, in schools that experience internet challenges. A study was undertaken to evaluate the pilot and to identify its strengths and weaknesses to inform any future deployment. Focus group interview schedules were developed for learners, teachers and managers in consultation with the Ministry and with COL. Then the evaluator visited a selection of schools involved in the pilot to observe and interview the participants. The evaluator also met with Ministry officials. In reviewing the findings, it appears that the Aptus resources included in this exercise were useful for both teachers and students, providing that:

- the teacher had reviewed the materials related to the topic under discussion prior to the class in which they were relevant and were being addressed;
- the materials were being used to address specific student learning outcomes (SLOs) for which they had been designed;
- the students had access to the materials (preferably prior to the class in which they were being used) at least at the same time as the learning outcomes were being addressed, and
- assessment(s) was/were directly related to the materials under discussion or emerging from discussions of the materials (COL, 2023).

So, it is not just about having the OER and providing access to them offline, but it is also about how teachers mediate engagement with those resources, taking into account the environment in which deployment is taking place. These findings accord well with findings from elsewhere, such as the Learning Passport initiative (Learning Passport, u.d.; Cambridge University Press & Cambridge Assessment, 2020).

Conclusion

With too few teachers, schools and other support services, we need to consider all the different ways in which we can provide access to teachers and learners to appropriate curriculum-based content whether they are connected or not and whether they have devices or not. Therefore, it seems likely there will continue to be a role for providing print-based materials, broadcast materials and other offline materials, including digital OER, which can be accessed via Aptus or AptusPi, all of which could support continuity of learning and professional development when campus-based provision is disrupted and so contribute to improved systemic resilience (Kanwar & Daniel, 2020). With the increased interest in the possible use of generative artificial intelligence services (GenAI) in education, and the rapid rise of specialised Language Models that require only a small amount of computing power (Ng, 2023), COL has also recently begun trials to deploy offline GenAI services in Aptus using open-source Language Models.

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Author Notes

https://orcid.org/0000-0003-4468-9869
https://orcid.org/0000-0002-5667-6945

Tony John Mays is Director: Education at the Commonwealth of Learning and also leads the Open Schooling initiative. Email: tmays@col.org

Mr Ricky Zhiyong Cheng is COL's Knowledge Services Manager. Ricky's work includes the deployment of various systems on SharePoint, Dspace and other pilot projects. Email: rcheng@col.org

Cite as: Mays, T. J., & Cheng, R.Z. (2024). Exploring offline e-learning for resilience: A case study. *Journal of Learning for Development*, *11*(2), 304-310.