CHAPTER

5

Caribbean Open Textbooks Initiative

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Abstract

This chapter considers both the role that Open Educational Resources (OER) can play in supporting school-level pedagogical transformation, and the policy approaches to initiate transformation in public school systems. Focusing on the context of Antigua & Barbuda, the chapter recognises that, for change to be effective, it needs to be driven at the systemic level, as this ultimately directs most public school systems' operations. The chapter explores different steps taken, starting from the government's commitment to information and communication technology (ICT) infrastructure, fostering a supportive policy environment, and developing a school ICT integration plan to ensure schools' ICT needs and requirements. It describes the deployment of an OER Virtual Learning Environment (VLE) prototype, and the compilation of an online mathematics "textbook" from available quality OER. The chapter concludes by highlighting the kinds of systemic actions important for the proponents of OER to use in building sustained pressure for long-term, educationally effective systemic change.

Introduction

In the Caribbean, the development of an open textbook prototype arose from regional policy workshops held jointly by the Commonwealth of Learning (COL) and UNESCO in 2012 and 2013. The goal of this open textbook prototype was to demonstrate that Open Educational Resources (OER) can be cost-effectively harnessed to create comprehensive, integrated multimedia packages of content that can replace conventional textbooks.

However, it was understood that the full transformative potential of OER may not be realised at the school level, as many OER initiatives typically focus on creating openly licensed materials (such as open textbooks) that tend to support traditional

educational models — with the assumption that the underlying curriculum, classroom-based organisational models, and roles and responsibilities defined for teachers are what will best prepare young people for their subsequent entry into society and further education.

The approach thus recognised the imperative of not reproducing a content-heavy, top-down model of education, as well as the need to move away from teacher-centric models in which the student is primarily a passive "consumer" of prescribed educational content and whose main task is to complete standardised assessments in order to receive accreditation.

It was also recognised that, for change to be effective, it needs to be driven at the systemic level — ideally by government-level policy changes, as such changes ultimately direct the operations of most public schooling systems. Such change is difficult, as it requires consensus from a wide range of stakeholders, most of whom are inherently conservative and tend to protect traditional educational models. Likewise, the short-term nature of political appointments inhibits risk-taking in these public systems.

For all these reasons, change was to be incremental in nature so as to create as little disruption as possible and to create buy-in from all stakeholders. Furthermore, this would allow planning for the use of technology as a regular occurrence and not just a once-off event, enabling systems to keep pace with global trends and to learn from and respond to previous changes.

To test this approach, an action research pilot study methodology was adopted. The context was Antigua & Barbuda, located in the Eastern Caribbean, which has a very small secondary school system consisting of about 25 schools. The focus was specifically on mathematics education. The government has expressed commitment to implementing significant systemic transformation in schooling, recognising that the current schooling system is not adequately preparing students for their future, and is especially not yet contributing to the development of new economic sectors.

The research was a collaborative effort between Neil Butcher & Associates and the ICT Unit in the Planning Office of the Ministry of Education,

An initial pilot study was conducted in March and April 2014. Then, building on the lessons learned, a second research phase commenced in March 2015 (due to conclude in October 2015).

Data collection for the action research has been drawn from all mathematics teachers in Antigua & Barbuda who attended workshops and were asked for their opinions. Additional detailed information, however, is being drawn from four schools where pilot projects were run during both research phases. The findings from the research are expected to shape mathematics education for all schools on conclusion of the research.

Ensuring the Necessary Infrastructure

Prior to the pilot, the government took a first step in actualising its commitment to integrate ICT in education. It committed to provide infrastructure to support change through, for example: the Community Computer Access Centres, Mobile IT Classrooms, a One Laptop per Teacher initiative, free Internet access, and

Samsung Galaxy tablets supplied, with free access to mobile 4G LTE connections, to every senior secondary student in the country. This commitment aimed to cover all the secondary schools and not just those targeted by the pilot study. This clearly demonstrated the government's commitment to providing ICT infrastructure, which is a first key requirement for systemic change. However, a new policy environment to leverage the effectiveness of the infrastructure investment was required.

Shaping the Policy Environment

The ICT in Education Policy in Antigua & Barbuda, approved in June 2013, contains a highly ambitious agenda for educational transformation and encapsulates a strong commitment to OER and open licensing. The policy highlights the shifting role of educators, from teaching content to facilitating learning and allowing for self-paced learning. It also articulates how this approach can mitigate drop-out rates and facilitate self-employment.

While this policy is an important first step in leading systemic change, by itself it is not a sufficient condition. Consequently, the next step in the process was to develop a comprehensive new ICT Master Plan to guide future procurement and deployment of ICT in schools. The activities identified within the ICT Master Plan, developed in October 2013, interpreted the policy in ways that promoted educational transformation. A few examples include a requirement that OER be exploited, that government release its education materials under an open licence to encourage sharing, and that senior secondary students have access to their own digital devices.

The new ICT in Education Policy highlights the importance of ensuring that school leaders play a critical role in defining future plans for the use of ICT in classrooms. As part of ensuring that the schools' needs and requirements are central to all future planning, a School ICT Integration Plan was circulated to schools. The aim was to: assess what technology schools already have and whether or not it is functional; define schools' priorities regarding ICT procurement; present plans that schools have for using ICT; understand how schools maintain their ICT; and determine competency levels of staff and their professional development needs.

Therefore, the ICT in Education Policy and ICT Master Plan are modelling a school-centred approach to policy implementation, in ways that, it is hoped, mirror the underlying ethos of the learner-centred approach touted for schools themselves.

Promoting Teacher and Student Engagement

Within this environment, the pilot study action research was conducted to explore how best to adopt new teaching and learning methodologies to encourage greater student engagement and responsibility, and to gauge student and staff reactions to a change in teaching and learning methodologies.

The pilot placed heavy emphasis on harnessing OER to enable student-led content creation, with a long-term view of demonstrating that students can use OER to create self-paced learning environments that significantly accelerate their journey through the formal curriculum.

OER VLE Prototype for Antigua & Barbuda

The pilot design was influenced by the vision of creating a student-centric learning environment. The plan noted that students should help to develop and work through structured pathways of learning (with associated multimedia content for each subject), developed in a Virtual Learning Environment (VLE).

Initially, the pilot exposed students and staff to a VLE called Canvas and a repository of OER that supported the formal curriculum (discussed in more detail below). An Internet search for appropriate OER was conducted to find quality resources for the pilot activities. An OER repository was added to the Canvas VLE and populated with over 500 openly licensed mathematics resources from 72 different providers. The OER mathematics content providers ranged from large organisations committed to developing quality education materials, right down to individual educators who have released their own useful content with an open licence. Well-known content providers included the CK–12 Foundation, Khan Academy, and Commonwealth of Learning. Content was also added from the Eastern Caribbean's own *Mastering Mathematics* video series.

This content was compiled by a specialist mathematics educator, who organised and sequenced the resources within the VLE component of the prototype so that they responded to specific objectives as stated in the Caribbean Secondary Education Curriculum (CSEC) Mathematics syllabus. Thus, an online mathematics "textbook" was compiled from available, high-quality, free OER.

For the second phase of the pilot the OER were migrated across to the Gooru platform[1] that integrated both the repository and VLE into one seamless experience. The Gooru platform also offers enhanced user-friendliness for educators and students alike.

While the prototype can be used like a traditional static textbook, the OER VLE prototype's real power lies in providing students and educators the tools to manipulate and customise its resources. In addition to accessing and repurposing mathematics content, the prototype also offered automatically marked quizzes and tests, which could be adapted to suit local needs. It was anticipated that the ability to edit the "textbook" to suit personal learning preferences and local contexts would, in time, encourage reflective practices amongst students, teachers, principals and education officers as to the nature of traditional practices and create a demand for more flexible approaches to learning and teaching. Existing open source education tools were used to provide the OER textbook prototype's functionality. Thus, two systems were interlinked: a VLE and a content repository.

Virtual Learning Environment

The Open Source Canvas VLE and later the Gooru platform have been deployed to offer seamless transition and easy navigation between resources of different formats. Consequently, digital OER worksheets or textbook pages in a PDF or MS Word format could be followed by a streamed YouTube video or an interactive website that contained Java programming. To the user, there was no deviation from the learning pathway clearly indicated by the VLE navigation tools (Figure 5.1).

1 http://www.goorulearning.org

Figure 5.1: Gooru interface of the homepage for Measurement (Specific Objective 1).

Both Canvas and Gooru offer good assessment functionality, allowing for the construction and easy adaptation of tests. Both allow public access so that users can bypass registrations, logins and password screens, allowing ease of access to the "textbook." However, when a class or group wishes to manipulate the "textbook," the VLE offers customisable permissions that can be set up for individual staff or students. Another piece of functionality offered by the VLE that was essential to the prototype model is the ability to deploy copies of a master course so that different groups can have their own version of the "textbook" to manipulate and develop.

Electronic Content Repository

Behind the VLE user interface is a content repository. It provides functionality for the storage of electronic documents and "tagging" of all OER. The repository stores metadata for all the OER used in the prototype, and every OER collected has been tagged in terms of its relationship to the Caribbean Examination Council's (CXC) CSEC Mathematics curriculum. This gives student and staff developers looking to rework the '"textbook" an initial bank of existing and additional OER to peruse and consider — all linked to the curriculum. The repository's search facility allows users to search according to curriculum statements, subject topics, service providers and resource formats.

An activity in the second phase of the pilot is to cross-map the CXC CSEC curriculum standards to those of the U.S. Common Core within the Gooru platform, thus unlocking access to thousands more potential OER for teachers to consider when repurposing the "textbook." An additional function of the repository is to provide a facility that allows the scaling up of the "textbook" so that it can be quickly adapted to support curricula from elsewhere. Additional curriculum taxonomies (from South Africa and Kenya) are being added and mapped against the existing taxonomy to enable linkages to appropriate OER already in the database.

Structure and Content of the Open Maths Textbook

At the heart of the prototype are quality OER and a curriculum structure that provides a framework within which to locate these resources. The CXC CSEC

Mathematics curriculum is aimed at junior secondary or middle school, and covers two years of study. It contains 10 mathematics topics, each with its own set of specific objectives. The topics and specific objectives provided the initial structure for the OER Textbook Prototype and guided selection of the first batch of OER.

Against the structure provided by the CSEC Mathematics curriculum, a small team of content experts selected 517 OER based on whether they cover mastery of the specific objectives. Other selection criteria, included, for example, that resources should:

- be of high quality and accurate, be easy to read and understand by students in Grade 9 and 10, not too text dense, and have clear graphics, illustrations and video;
- comprise a mix of media (video, interactive components, audio and strong visual elements) to minimise text density and appeal to different learning preferences;
- contain a mixture of "voices" so that multiple perspectives and approaches could be presented as options for students to consider; and
- preferably be from a Caribbean context.

It should be noted that while mathematics has been targeted in this research and pilot, the model is easily replicable for any subject where there are sufficient high-quality OER.

The initial layout of the OER "textbook" also included sequencing of materials as an important component of the design. OER were selected so that when users progress through them in the specified order, they will be better able to develop the skills and knowledge described by the curriculum objectives. The initial layout of the OER, however, was always considered to be a demonstration of what was possible and to act as a starting point for student and teacher customisation. The intention was never to be prescriptive or fixed.

Many of the collected OER have built-in activities or interactivity, encouraging user engagement. However, the initial design of the prototype assumed that users should have additional opportunities to assess their progress against the curriculum objectives. For the initial deployment of the prototype, 10 self-assessment quizzes (one for each topic and with a minimum of one question per objective) were developed. Located at the end of each topic, these quizzes were designed to be formative assessments to provide immediate feedback to the user and provide guidance on incorrect responses. However, like the content, the tests were designed to be customisable. Teachers and students can add or delete questions, reword instructions, add additional distractors, and so on. They can even add additional assessment opportunities at different stages of the mathematics topic.

Deployment Strategies

Three potential deployment strategies have been identified:

- **Minimal Deployment Strategy (public access/teacher reference)** – Under this deployment strategy, the OER VLE is accessed using public or guest access to the materials. Resources can be read and used but not

manipulated or changed. This strategy might appeal to self-taught students who wish for quality instruction to supplement their experience. It allows students to work at their own pace through the sequenced OER, using self-assessment opportunities to test their mastery of concepts and skills. In this set-up, the student uses the OER VLE very much like a regular textbook, but also benefits from interactive elements within the OER and the self-assessment opportunities that provide immediate detailed feedback.

This simple set-up can also be used by new or inexperienced teachers who require a source of quality teaching and learning materials, selected and vetted by a senior educator with many years of experience. These new teachers can use the materials either as a reference or as a structured environment for their lessons, where the teachers act as a facilitator or guide through the materials. The OER VLE provides a sequencing of the materials and access to varied formats that will, one hopes, appeal to different learning preferences.

- **Standard Deployment Strategy (contextual repurposing by educators)** – The standard set-up requires teachers to be provided permissions to access and edit a school version of the master OER "textbook." Under this set-up, users are issued rights that allow them to change the textbook content and activities. This allows the textbook to be manipulated to suit local learning contexts. OER, including teacher's own notes and worksheets, can be added to the modules, and other resources can be deleted if deemed unsuitable by the teacher. The sequence of the resources can also be changed. Those OER whose licensing allow repurposing can be downloaded, adapted and re-uploaded. Furthermore, teachers can add extra questions to the quizzes or even offer more opportunities for students to test themselves. The unique nature of OER and the development tools built into the VLE encourage this repurposing, which is absent in traditional textbooks.
- **Advanced Deployment Strategy (students as content authors)** – The OER "textbook" prototype's tools and permissions also lend themselves to more student-centred teaching and learning strategies. Using exactly the same tools as provided to educators in the standard set-up, this deployment strategy allows students to be provided editing rights. Students can then create modules in a way that makes sense to their peers, using examples drawn from their collective experience. As students do not start from scratch, this quickly allows them to acquire the skill or knowledge and then consider how to adapt the module for a new audience.

Pilot Study

In March 2014, as part of the initial action research, four schools in Antigua & Barbuda were identified to pilot each of the OER VLE Prototype's deployment strategies with the teachers and students. The pilot schools were provided a set of activities that guided them in using the prototype as per the three deployment strategies outlined above: a basic "textbook," a tool that could be repurposed to support individual teaching styles, and an environment where students could adapt and write their own learning materials for both themselves and their peers.

To expedite the repurposing of the OER VLE prototype to better suit specific needs, a set of simple how-to guides were developed for the students and staff.

On completion of the pilot, teacher experiences were collected using an online survey. The results suggested that teachers considered a number of different ways to deploy the prototype within their current teaching styles. They enjoyed the access to new digital formats and resources that the prototype provided (particularly video and interactive media), and found it easy to repurpose the course materials to better suit their teaching styles. Additionally, they reported that there were sufficient assessment opportunities for students to measure their mastery of curriculum objectives. They tended to use the prototype as is, but welcomed the functionality to repurpose the prototype and include contextually relevant/localised content.

However, there was also evidence to suggest that the current form of the prototype was not incorporated into daily teaching strategies. Mitigating factors included lack of sustained pressure by the school management/education ministry to use the tool, difficulties associated with accessing computers and the Internet (i.e., access and cost), and complexities in management of the prototype — in particular, generating school instances of the materials and the granting of permissions. Nevertheless, some educators reported that they were keen to upload and share their class materials within the prototype. Statistics from the prototype platform, however, showed that adoption and use was not sustained effectively after the initial launch.

Given this, in 2015, the Maths Open Textbook was relaunched to teachers and students. It was migrated to Gooru, which was considered a more user-friendly platform. The interface allows educators and students to easily repurpose the various sections of the "textbook." The creation of copies of the master collections ("remix copies" in Gooru's terminology) is especially easy, and dispensed with complex permission systems that were necessary in the earlier VLE. Another advantage is the seamless integration of both the user interface and the repository, which allows easy navigation around the VLE and linkages to resources. The Gooru platform also offers access to a comprehensive OER collection that is already tagged to the U.S. Common Core.

Teachers were trained to use and manipulate the Maths Open Textbook resident on the Gooru learning platform. They were then invited to repurpose and present their own interpretations of the mathematics content. During this process, it was evident that there was a gulf between educational theory and its implementation. The teaching and learning environment, typical of traditional secondary schools, is often restrictive and conservative and demands high levels of compliance. This environment appears to stifle attempts at creativity and a willingness to experiment. Teachers also appeared to fear failure, and therefore did not take risks by developing new teaching and learning strategies different from those mandated by authority structures. However, when confronted with a new strategy, endorsed by the ministry and therefore in their minds "approved," both groups — but especially the students — showed willingness to venture into new territory.

To enhance the use of the Maths Open Textbook, it is planned to encourage those teachers who have successfully demonstrated its use to integrate the platform into

their teaching, covering at least 10 specific objectives in any one maths topic. Once they have mastered the Maths Open Textbook, they will form part of the team to help roll out usage on a larger scale.

The second phase of the action research (March–October 2015) includes teachers selecting the section of the curriculum on which they will focus, identifying technology needs and preparing relevant master sections of the "textbook." During the pilot, teachers will assist with mapping the CXC CSEC and U.S. Common Core standards. This activity is designed to increase the number of existing math OER linked to the Caribbean standards. They have also been tasked to develop a set of case studies describing their experience, both positive aspects and challenges.

One of the outcomes of the pilot has been to identify and train a core of teachers to support other teachers on the island in using both OER and the textbook platform to deliver learning. The pilot will also help the Ministry of Education develop such a strategy to roll out the "textbook" to all the island educators.

Preliminary outcomes of the second pilot study suggest that the user experience has been greatly enhanced using the Gooru learning platform, encouraging adaptation of the "text" by teachers. Additionally, the improved ease of use has encouraged increased student involvement in terms of adapting and improving the OER collections aligned to curriculum statements. However, it has also been evident that the model is dependent on access to digital devices and Internet connectivity. In the early part of the second phase, access for students to both devices and connectivity proved problematic, and subsequently the lessons were a failure. Only in the later part of the phase when access was improved did the study yield positive results.

It is anticipated that with a successful conclusion to the pilot, the OER Maths Textbook will be rolled out to the country's other 21 schools. The model can also be applied to other subjects. This would support the ministry's intention, as stipulated in its ICT in Education Master Plan, to use OER to impact positively on transforming teaching methodologies from predominately didactic to more student-centric approaches.

Conclusions

The work in Antigua & Barbuda has demonstrated that, at the core of the transformational challenge of OER, is the reality that patterns of day-to-day teacher-student interactions are very heavily circumscribed by the formal curriculum — a problem exacerbated by the heavy, and in many instances growing, emphasis on high-stakes examinations that test student success in these formal curricula. Unless key players who hold high levels of influence in these systems — most notably, parents and teachers — can be convinced that alternative models of school organisation can improve (or at least not erode) performance in these high-stakes examinations, social tolerance for any significant systemic change is likely to be negligible.

This is why OER initiatives that simply replace proprietary resources with openly licensed ones, but with no major intention to shift the basic productivity of teacher-student interactions, are so unlikely to lead to any systemic transformation. The experiments conducted have demonstrated a significantly

different application of OER, one that is notably cheaper even than OER textbook initiatives. (Given the vast ecosystem of OER that exists already online, once the VLE infrastructure is established, basic capacities are developed, and models can be shown to work successfully, there is no major additional investment required of any kind.)

While the work done in Antigua & Barbuda is too early to claim success, many important tools are already emerging that might provide a roadmap for effective change. These include:

- proactive, visionary statements of policy intent,
- detailed strategic plans, with clear targets that work towards the achievement of the policy vision,
- budgetary and logistical commitments from government to ensure that ICT infrastructure is universally accessible across the whole system,
- strong engagement with principals and school management in planning the integration of ICT into schools on an annual basis,
- creation, through prototypes, of models that demonstrate the potential for OER to serve a transformative educational agenda,
- strong engagement and professional development to enable core groups of teacher "champions" to lead the process of change, and
- careful evaluation to measure the impact of changes ushered in by innovations as they are introduced.

Thus, while success is far from assured, this case study provides possible pointers to the kinds of systemic actions required so that proponents of OER need no longer chase after "low hanging fruit" that simply reinforces the failed models of schooling. Proponents can, rather, seek to build sustained pressure for long-term, educationally effective systemic change. Such cases attempt to place transformative tools and strategies for stakeholders at all levels of the education system: ministerial, district, school and classroom. Changes at a systemic level are important in effecting positive and lasting change.