Chapter 15

An early stage impact study of localised OER in Afghanistan

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Summary

This study evaluates a group of Afghan teachers' use of Open Educational Resources (OER) from the Darakht-e Danesh Library (DDL) – a digital library comprised of educational materials in English, Dari and Pashto – investigating whether these resources enabled improvements in teaching practice and led to improved subject knowledge. Conducted with secondary-school teachers in Parwan, Afghanistan, who accessed the DDL over a four-week period in 2016, the study asked the following research questions: To what extent did teachers in this study access and use OER in the DDL? Did access and use of OER in the DDL enhance teachers' subject-area content knowledge? Did access and use of DDL resources enhance teachers' instructional practices? To what extent did teachers' understanding of OER and its value change?

The study utilised quantitative and qualitative methods to examine the behaviour and practices of 51 teachers in rural Afghanistan, all of whom were teaching at the secondary level or affiliated with a local teacher training college. The study collected data from server logs, pre- and post-treatment questionnaires, lesson plan analyses, teacher interviews and classroom observation. A purposive sampling technique was utilised to select the teachers, drawing from educational institutions with which the Canadian Women for Women in Afghanistan non-governmental organisation had previously interacted. ▶

Findings indicate that when the DDL was used by teachers, the OER accessed positively impacted teachers' knowledge and helped them in lesson preparation. On average, the 33 teachers who visited the lab at least three times downloaded 12 OER each over the course of the study. However, a number of teachers did not download or use any OER, and many more preferred to continue using only the traditional textbook to prepare their lesson plans even after exposure to the DDL. Furthermore, while teachers found the OER helpful in creating assessment activities for their students, there was no observed improvement in teacher understanding and use of formative or summative assessment. Lastly, there was limited understanding among the teachers of the exact meaning of "open", with most viewing OER as learning materials obtained from the internet, libraries or simply from outside of their school. Teachers made little reference to licensing or to the accessibility characteristics of OER. Thus, while teachers who used OER appeared to benefit from these resources, the concept was new to them, representing a disruption to the familiar way of preparing and delivering lessons.

For further diffusion of OER as an innovation in teachers' learning and practice, concerted action will be required to build the collection of OER available in Afghan languages, provide support in how teachers might integrate OER into their teaching, and ensure connectivity in the context of limited internet access in rural areas and a teacher population with widely varying levels of proficiency in using digital technology.

The dataset arising from this study can be accessed at:
https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/622

Acronyms and abbreviations

CW4WAfghan	Canadian Women for Women in Afghanistan
DDL	Darakht-e Danesh Library
ICT	information and communication technologies
NGO	non-governmental organisation
OER	Open Educational Resources
TESSA	Teacher Education in Sub-Saharan Africa
TESS-India	Teacher Education through School Based Support in India

Introduction

Background

Since the Taliban regime ended in late 2001, the basic education system in Afghanistan has experienced a rebirth with millions of girls returning to school or enrolling for the first time, new teacher colleges opening in every province and ongoing efforts to reform the curricula. There are, however, still substantive challenges. With the devastating impact to

the nation's economy and infrastructure of a war that raged continuously since 1978, and the presence of an ongoing Taliban insurgency that has singled out the education sector for violent attack due to Taliban opposition to secular and girls' education, Afghanistan is a difficult environment in which to teach and learn.

Afghan teachers contend with a daunting lack of resources. Most schools do not have libraries or science laboratories, many students go without textbooks, and teachers have little material to help them work through a new curriculum that many struggle to understand. The school curriculum is also acknowledged to be in need of further development (Georgescu, 2008). Afghan textbooks, although updated several times in the post-Taliban period, are considered to be riddled with errors, poorly sequenced and of generally low quality (Tani, 2014).[1] At the secondary level, in particular, there are extreme textbook shortages and no teachers' guides (Nazari et al., 2016). A study of teacher education in Afghanistan (Nicholson, 2013) found that even in Kabul, the largest urban centre in the country, students often lacked access to textbooks, textbooks were not distributed in a timely manner and teacher guidebooks were often not distributed to teachers – a finding echoed by Bethke (2012).

Additionally, despite greatly increased enrolment and thousands of schools being constructed or rebuilt, the majority of Afghan teachers are not formally qualified to teach because they have not met the minimum qualifications, which is two years of training at a teachers' college. Unqualified teachers may not be knowledgeable about their assigned subject area or competent with pedagogy, including assessment of student performance. They may use traditional, didactic teaching practices and rely on student textbooks to guide their lesson planning and assessment practices. Teacher morale is often low due to poor teacher compensation, challenging work environments and limited intrinsic interest in the profession. Weak teaching capacity coupled with a lack of resources and other delivery challenges such as minimal instructional time (classes typically are 30 minutes in length) have resulted in many Afghan pupils being unable to read by the time they enter the upper primary school level (Grades 4–6). One study found that, depending upon the province, 25–50% of Grade 6 students in Afghanistan could not read, and 20% fewer Afghan students in government schools were able to answer basic comprehension questions by Grade 6 when compared to Grade 4 students in Iran (ACER, 2013). This situation puts students at an extreme disadvantage by the time they enter secondary school.

Open Educational Resources and the Darakht-e Danesh Library

There are many contributing factors to the current education crisis in Afghanistan, but one that has been particularly neglected in discussions about the situation is the lack of good teaching and learning material available in Afghan languages.[2] The publishing sector in general, and the educational publishing sector in particular, is weak and lacks diversity

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1   See, for example, https://iwpr.net/global-voices/afghanistan-new-textbooks-baffle-teachers.
2   Afghanistan's two official languages are Dari (Afghan Farsi) and Pashto. However, there are at least 42 languages spoken today in Afghanistan, although many are in danger of falling out of use. Of these languages, 35 are indigenous to Afghanistan, highlighting the richness of linguistic diversity in a small geographic area. However, only four languages spoken in Afghanistan are considered to be standardised and institutional, while five are developing, 20 are vigorous, five are in trouble and seven are dying. Languages such as Inku, Mogholi, Pahlavani and Parya already have no known speakers; Wotapuri-Katarqalai is now categorised as extinct; and Domari, Prmuri and Tirahi are considered nearly extinct (Simons & Fennig, 2017).

of content, relying primarily on imported books. Non-governmental organisations (NGOs) working in the education sector have produced training materials and other resources for teachers, but they tend not to disseminate their materials beyond their own project beneficiaries, and there is a limited culture of sharing materials openly within the education sector. It is therefore difficult to find quality teacher resources in Afghan languages for educational use.

The global Open Educational Resources (OER) movement has made large collections of materials available to educators free of charge and without certain copyright restrictions, providing teachers with direct access to valuable sources of knowledge as well as new teaching tools and pedagogical approaches. However, teachers in the developing world who speak languages other than English are largely excluded from taking advantage of this wealth of free information. This is particularly the case in Central Asia, as languages from this region have little representation in digital libraries (Oates, 2009), including libraries with openly accessible materials. It was in consideration of these challenges in the education context that the Darakht-e Danesh ("Knowledge Tree") Library (DDL) for educators in Afghanistan was established in 2014 by the Canadian Women for Women in Afghanistan (CW4WAfghan) NGO.[3]

The long-term goal of the DDL is to contribute to the improvement of the quality of basic education in Afghanistan and to improve student learning outcomes in Afghan classrooms. It is envisioned that increased access to a growing collection of OER will improve both teachers' subject knowledge and teaching practice. Furthermore, in developing the DDL, it was hypothesised that the OER approach may offer a potential solution to some of the education-quality challenges in Afghanistan if OER is developed in local languages and if the technology to deliver resources is adapted to respond to the infrastructure challenges, such as limited electricity and poor internet access.

The DDL is a digital educational resource collection for teachers, providing relevant subject information, lesson plans, games, experiments and books in over 30 subject-area categories ranging from biology to fine arts. The DDL housed around 2 000 resources at the time of writing (with new resources being added daily). The DDL uses an innovative, interactive, user-friendly, multilingual, custom-designed web platform, and provides a service in the three languages used in Afghanistan's public school system (Dari, Pashto and English). The DDL is Afghanistan's first OER initiative, serving as an independent source of knowledge, information and pedagogical tools for Afghan teachers, with the aim of addressing the extreme lack of educational materials for teachers in Afghanistan who have very limited access to relevant and high-quality educational resources.

Users are also encouraged to contribute their own content by submitting it to the site. To date, however, most content has been produced by the DDL team, drawing from various OER available in English and translating them into Dari and Pashto. Translations are carried out by DDL's team of volunteers – bilingual Afghans around the world who contribute to developing the collection by giving their time to work on translations. Translations and submissions are reviewed by DDL's full-time multilingual editor, who approves final versions for publication after making any revisions and checking the translation against the original.

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3   The library and background information about its creation can be viewed at www.darakhtdanesh.org and www. ddl.af.

Edited versions are shared with the volunteer to support their continued development. If a translation requires minor revisions, it is sent back to the volunteer for further work. In cases where a translation is of poor quality, it is not used and the volunteer is not assigned more work. The library also sources existing educational materials in Dari and Pashto by formally seeking permission from the creators to include them in the collection. Material submitted by users is checked by the editor to ensure it meets the library's development standards.

Several different access models have been employed to make the DDL accessible to educators in Afghanistan, the overwhelming majority of whom do not have access to the internet to discover and use the DDL independently. The DDL can be downloaded as an application that is useable offline on a feature phone, smart phone or tablet. It can also be installed in a networked computer lab using one computer configured as a server with the other computers as clients, allowing the library to be accessed offline (however, in order to synchronise the collection and to send usage data to the main DDL server, the server computer must occasionally be connected to the internet via a 3G or 4G connection).

As staff members of the CW4WAfghan NGO that founded the digital library and engaged in ongoing work to expand the DDL in terms of both its content and reach to more users in Afghanistan, the authors have an inherent interest in better understanding the impact of the OER the DDL have developed or adapted through translation and localisation, and the platform through which they are disseminated, to guide forthcoming efforts. It is also the authors' hope that this chapter will contribute to filling the gap created by the lack of research to date on the value of localised OER in developing country contexts.

Literature review and theoretical framework

This study considers three levels of impact from teachers' use of OER: access and use, knowledge and practice, and understanding of OER. For access and use, we sought to understand the frequency with which the teachers in the study made use of OER, considering the DDL useability and relevance for the target users, while also considering their level of awareness and acceptance of OER (addressing research question 1). For impact on knowledge and practice, we sought to understand whether use of OER in the DDL impacted teachers' knowledge of subjects taught and their practice as teachers, such as the content they plan to deliver in a lesson and the teaching methods used to deliver and assess the lessons (addressing research questions 2 and 3). In order to probe teachers' understanding of OER, we sought to better understand whether teacher perceptions of "open" and its value, along with what constitutes OER, changed during the course of the study (research question 4).

We consulted literature on local-language OER initiatives in comparable environments – the extent of which is quite limited[4] – in addition to literature on the value of OER for increasing subject expertise and instructional practice, and literature relevant to OER uptake.

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4 Most of the outputs here are produced by the Teacher Education in Sub-Saharan Africa (TESSA) and Teacher Education through School Based Support in India (TESS-India) projects of UK Open University, and the South African initiative advancing community-based open education, Siyavula.

This study aims to contribute to the "emerging framework for localisation to ensure more equitable and sustainable OER development and use" (Buckler, Perryman, Seal & Musafir, 2014, p.222), and to understand how increased access to localised open content may impact teachers' subject knowledge and teaching practice in Afghanistan. Open content offers many educational opportunities and has the potential to advance key development and human rights goals in all contexts. However, as Hatakka (2009) explains, there are primary inhibiting factors for OER reuse in localised contexts in developing countries. In Afghanistan, these inhibiting factors are language, relevance, access, technical resources, quality and intellectual property. In a podcast, Wiley (2007) discusses how the process of localisation addresses these inhibitors through "the tailoring of content by locals for locals using appropriate, sustainable technologies".

Measuring OER uptake and use

De Hart, Chetty and Archer (2015) discuss the various phases of uptake through which individuals and institutions progress when integrating OER into their practice. Following Rogers' (2003) five stages of innovation diffusion, they frame OER adoption within the following "stages": (1) knowledge (awareness); (2) persuasion (interest); (3) decision (evaluation/benefit); (4) implementation (trial); and (5) confirmation (adoption). These phases serve as a useful framework to identify where teachers are positioned in their use of OER for teaching and learning, and we apply this framework to interpret our own findings. The pace at which individuals progress through these stages varies, depending upon the level of localisation and the relevance of content, local support, technology available, institutional and cultural practices, teacher access to resources, and prior knowledge of OER. Ascertaining which stage an individual teacher is at can help determine the respective importance of these variables on uptake.

Localisation as a factor of use

Drawing on the TESSA and TESS-India experiences – OER collections developed for East Africa and India, respectively – Buckler et al. (2014) emphasise the role of localisation in making OER relevant and useful for the educational reform aspirations of developing countries, in contrast to transferring OER from the developed world to the developing world where it may have limited uptake and impact.

The TESS-India experience also highlights the cultural and institutional shifts required to overcome teachers' negative perceptions of the value of OER. As others have found, "dumping content onto a server isn't the most effective way to encourage fast learning" and "the best way to spread content is with locally created content".[5] The importance of content rooted in the cultural and geographic contexts in which teachers teach is further discussed by Jimes, Weiss and Keep (2013), who show that teachers view content created by local field experts and scholars as more useful and reliable than textbooks created by governments or for-profit publishing companies. As Wenger has emphasised (in opposition to passively consuming the work of others), "in order to engage in practice, we must be alive in a world where we can act and interact" (1998, p.51).

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5   https://opensource.com/education/14/8/crowdsourcing-open-education-africa

Castells (2000, p.31) makes a further argument that can be applied to the case for localisation, contending that sites of use should be proximate to sites of innovation if the goal is sustainable change; in such a context, "users and doers may become the same". Innovations made elsewhere and imported into an environment are unlikely to spur new innovations or nurture communities of practice that can improve and adapt a tool to suit their needs.

User language and accessibility

One of the areas of impact this study has considered is OER access and, within that context, the availability of OER in the language best understood by users. At the DDL, we emphasise language accessibility as the pre-eminent feature required for OER uptake by Afghan teachers and have concentrated our efforts on localising the DDL collection according to user language. In general, multilingual digital platforms are understudied, remaining "a bit of an enigma" (Diekema, 2012, p.10) – particularly as regards multilingual digital libraries in the developing world. While the theme of accessibility is prevalent within the OER literature, language as a criterion of accessibility is undersupported in practice and underresearched, with very few OER collections supporting multiple languages, alphabets or scripts (West & Victor, 2011). The literature review validates that there is little precedent to draw upon when assessing the potential of local-language OER as a feature of accessibility.

Budzise-Weaver, Chen and Mitchell's (2012) case study of four multilingual digital libraries offered relevant lessons for the DDL, as they explore the potential for crowdsourcing content, for collaboration, and consider what design is appropriate for multilingual information systems, as does Leinonen, Purma, Põldoja and Toikkanen's (2010) work. Other studies affirm the lack of attention to the issue of multilingualism in OER repositories and digital libraries. Amiel (2013), for example, points to the lack of multilingual interfaces and metadata, and how this restricts use of these sites in other languages. Amiel (2013, p.132) also discusses how language is a neglected problem in the discourse on remixing, revision and adaptation of OER,[6] and notes how language revision "involves a substantial amount of thought into the process of localisation".

The notion that OER "travels well" (meaning that the resource can be easily transferred to different cultural and linguistic contexts) is also useful in supporting localisation, where users can take a resource and easily translate, adapt and/or recontextualise it to meet local needs (Petrides & Jimes, 2008). Since much of the DDL collection consists of OER that were originally in English and then translated into Dari and/or Pashto, we identify and select for translation resources that travel well, although sometimes content is adapted in other ways to suit Afghan audiences (such as by adding further graphics or explanatory notes for unfamiliar terms). Jimes et al. (2013) also discuss how localisation of OER can extend beyond the ability to translate and modify content for classroom needs, to providing a means to create formats that are useable in diverse local contexts. This impact study attempts to be a useful test to determine the useability and relevance of DDL OER, as localised OER.

In addition to the focus on delivery format, translation and localisation, there is a great need for more research on strategies that support *original* content creation for local use, particularly in cases where local languages are used. For instance, Buckler et al. (2014)

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6   The degree of openness of an educational resource is often determined with reference to the "5Rs": the extent to which users are free to retain, reuse, revise, remix and redistribute educational materials. See https://opencontent.org/blog/archives/3221.

call for more research to illuminate strategies of localisation, adaptation and *production* of OER by the user community. Although this study does not cover production of OER by the study participants, some of the OER in the collection are the creations of Afghan teachers who submitted their resources.

Value of OER for increasing subject expertise and improving instructional practice

Numerous factors contribute to teacher effectiveness, but the importance of subject knowledge and its impact on a teacher's ability to organise and use content effectively for student learning is key (Hattie, 2012). While research on the impact of subject knowledge on teacher effectiveness is largely confined to the United States, Metzler and Woessmann (2010), in a primary school study in rural Peru, observed that teacher knowledge of a subject resulted in a statistically significant impact on student achievement, and is a relevant factor in overall teacher quality and student achievement. Related to this, Misra (2014) explains how the TESS-India project is working towards improving the quality of teaching practice in India by making available OER that provide an opportunity for deepening content knowledge and trying new instructional approaches.

This study is an early-stage evaluation of the use of an Afghan digital library's resources by its small group of users over a short period of time, investigating whether the OER accessed via the DDL enabled teachers' use of educational content in their teaching practice and whether this content positively impacted educators' subject knowledge and pedagogical practice. To evaluate the effectiveness of the resources in the early stages of the library's development, this study asked the following research questions:

1.   To what extent did teachers in this study access and use OER in the DDL?
2.   Did access and use of OER in the DDL enhance teachers' subject-area content knowledge?
3.   Did access and use of DDL resources enhance teachers' instructional practices?
4.   To what extent did teachers' understanding of OER and its value change?

With this study, we hope to contribute to the literature some findings on the impact of OER from a context that has not previously been studied, but where challenges to teacher education exist that OER may be particularly well suited to address.

Methodology

This study primarily used quantitative methods and one qualitative process. Given that this is not a longitudinal or long-term project, and remaining cognisant of the challenges inherent in isolating causality of learning outcomes (Halai, 2004), the study collected a variety of data obtained from server logs, pre- and post-treatment questionnaires, lesson plan analyses, teacher interviews and classroom observation – all of which were conducted to understand what impact, if any, OER had on teacher practice and teachers' subject knowledge. This section describes the participants, followed by an explanation of the methods used, sources and the process for analysis.

The methodological approach employed in this study was designed in collaboration with OER research experts who mentored the DDL staff based in Kabul and assisted in the design of the instruments.[7] The Kabul team travelled to the study sites in Parwan to collect the data between March and June 2016.

Participants

This study examined the behaviour and practices of a group of secondary school teachers in Parwan, a rural province of Afghanistan, who accessed the DDL over a four-week period in April/May 2016. Respondents included 24 females and 27 males (51 participants in total), all from the same rural province and all teaching at the secondary level or affiliated with the local teacher training college. Of these, 25 were university graduates (with a bachelor's degree), two had postgraduate degrees, 23 had graduated with a two-year teacher college certification and one had a high school diploma.[8] Twenty teachers had 6–10 years of teaching experience, 13 had taught for 2–5 years, 12 had taught for more than 20 years, and six had taught for 11–15 years. Thus, there was a range of educational levels, as well as a range of experience in teaching.

Methods

A purposive sampling technique was utilised to select the teachers, drawing from educational institutions where CW4WAfghan had previously worked[9] and where the security situation was stable enough to allow access to the schools. Schools included a girls' high school (22 teachers), a boys' high school (20 teachers) and a teacher college (nine teachers who were also lecturers at the college). The teachers were interviewed and given a pre-treatment questionnaire to collect relevant basic demographic information about them (such as number of years teaching) and to probe their level of experience with digital devices, their current teaching practices, as well as their beliefs about and awareness of OER. Samples of their lesson plans were also collected prior to their exposure to the DDL. The teachers then participated in a workshop in which they were taught how to register an account on the DDL, search the library, save learning materials and share their own materials. There was no specific instruction given on how to integrate the learning materials into their teaching practice. This was left to the teachers to determine so that the researchers could observe their practice and how they chose to use the OER (if at all) in a more natural way.

The teachers were then given access to the DDL through several means at three physical sites that were selected because they were the only locations where teachers could regularly

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7   Consulting experts were Letha Kay Goger, an OER digital librarian and adjunct faculty in the School of Education at Fresno Pacific University, California, and Mythili Gowtham, an open learning and OER researcher from the Indira Gandhi National Open University, New Delhi.

8   This particular group of teachers had higher educational attainment levels than is typically seen in rural areas of Afghanistan. This is attributable to Parwan's proximity to the capital, Kabul, and a longer history of access to public education than many other areas.

9   This training, known as the Fanoos ("lantern") Teacher Training Program, consisted of basic teacher training covering both subject content and pedagogy, and was delivered for unqualified in-service teachers (teachers who do not have a teacher college diploma or any previous formal training as teachers). Teachers who completed the training were certified as qualified teachers by the Ministry of Education. The programme has been running since 2008, and has trained approximately 1 000 teachers annually, covering six Afghan provinces to date.

access computers: the computer lab in the local teachers' college and the labs in two public schools where the DDL was installed on an offline local network because there was no internet connection in the labs. Teachers made up to 15 visits each to the labs during the four-week period of the study, which was tracked by their log-in data. The offline DDL was also loaded onto teachers' mobile devices, enabling them to access the library from their mobile devices. In addition, two tablets pre-loaded with the DDL were placed in one of the school's libraries, where they could be signed out like books.

Data sources

Data on the teachers' use of the DDL library were collected during the approximately four weeks of lab time logged by teachers. Data from 18 teachers who visited fewer than three times were excluded as it was felt that fewer than three visits would be insufficient exposure to OER to measure changes in awareness, practice and knowledge. The total sample size for assessing DDL use was therefore 33 participants. Data were collected in three stages: before teacher training and use of the library, while the teachers were using the library and after they had used the library regularly (visiting at least three times). Table 1 shows the relationship between data collection processes and the types of impact that the data were designed to illuminate.

Table 1: **Types of impact measured and data collection instruments**

Type of impact examined	Instrument	Period administered
ACCESS and USE: Increased awareness and use of OER in DDL via a variety of access points and pathways *Research question 1:* To what extent did teachers in this study access and use OER in the DDL?	Post-treatment questionnaire	Post-treatment
	Server-log data	During and post-treatment
KNOWLEDGE and PRACTICE: Enhanced teacher subject-area content knowledge and improved teaching methods *Research questions 2 and 3:* Did access and use of OER in the DDL enhance teachers' subject-area content knowledge and/or teacher instructional practice?	Pre-treatment lesson plan rubric	Pre-treatment
	Pre-treatment questionnaire	Pre-treatment
	Post-treatment lesson plan rubric	Post-treatment
	Post-treatment questionnaire	Post-treatment
	Classroom observation rubric	Post-treatment
OPEN EDUCATION: Increased teacher understanding of OER and improved perception of its value *Research question 4:* To what extent did teachers' understanding of OER and its value change?	Pre-treatment questionnaire	Pre-treatment
	Post-treatment questionnaire	Post-treatment
	Server-log data	Post-treatment questionnaire

After teachers in the study accessed the DDL over the four-week period, the research team once again collected lesson plans from the 33 teachers as a proxy to measure teacher growth in subject knowledge, teaching effectiveness and use of OER. The post-treatment lesson plan took the same form as the pre-treatment lesson plan assessment, asking teachers to plan a lesson in their subject area addressing the four questions below. The teachers' answers to each of the four questions would indicate changes in specific aspects of teaching practice (aspects identified as indicators of change in teaching practice are indicated in brackets).

1. What resources and materials will be used in teaching? (subject knowledge, OER use, teaching practice)
2. What teaching method will be used to cover the topic? (teaching practice, OER use, subject knowledge)
3. What activities will be used to build student understanding or skills? (teaching practice, OER use)
4. How will student understanding be assessed during the lesson? (teaching practice, subject knowledge)

To assess whether their lesson design effectiveness with regard to the four questions improved, regressed or remained the same, each teacher's pre-treatment and post-treatment lesson plans were scored using a rubric[10] administered by a trained teacher educator.

After the lesson plan assessment, participant teachers were observed teaching in their classrooms. Observations were conducted by CW4WAfghan teacher educators. Each observation was logged in a rubric designed to identify the depth of the teachers' subject knowledge and presentation skills, effectiveness of teaching methods and activities, and the level of OER integration in their teaching. The classroom observation rubric identified teachers as "beginning", "emerging" or "effective" in terms of the following six criteria (aspects identified as indicators of change in teaching practice are indicated in brackets):

1. Learning objectives are discussed in the beginning of the session. (subject knowledge, teaching effectiveness)
2. Introduction of the topic is made clear and interesting. (subject knowledge, teaching effectiveness)
3. Examples, case studies or demonstrations are used to explain the topic. (subject knowledge, teaching effectiveness, OER use)
4. Teaching materials like slides, pictures and handouts are used to explain topic. (teaching effectiveness, OER use)
5. Effective teaching methods and activities are used to deliver and reinforce learning. (teaching effectiveness, OER use)
6. Supplementary teaching materials (OER) are used to explain the topic. (subject knowledge, teaching practice, OER use)

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10   The pre-intervention scoring rubric, post-training scoring rubric, teacher classroom observation rubric as well as other research instruments can be accessed as part of the published dataset arising from this study at https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/622.

The research team administered a post-treatment questionnaire with the same questions as the pre-treatment questionnaire, and interviewed the teachers to identify self-reported differences in their teaching practice and perception of OER before and after using the OER in the DDL. The pre- and post-treatment questionnaires asked those who used the library to consider their knowledge and skill levels before and after accessing the OER in the library. Specifically, the teachers were asked to report on their experience of using OER and the value added to their teaching, if any; changes in their knowledge as a result of using OER, if any; sharing of resources; their understanding of the concept of OER and openness; and any change in their teaching practices following use of the DDL. Background data on the following aspects were collected: sex, age, location, teaching level, subjects taught and number of years of teaching experience.

Following implementation of the questionnaire, interviews were also conducted with some of the teachers' students to determine whether and how (from the student perspective) the exposure to OER impacted on the teachers' practice in the classroom. Only the students of teachers who used the DDL at least six times were interviewed, reducing the number of student interviews to 22 out of the original planned sample of 50. However, because the students were reluctant to openly discuss their teachers' performance, this dataset was excluded from the data analysis.

Data analysis

Data collected in the field through the eight data collection instruments (see Table 1) were analysed in addition to demographic data. These data included languages spoken and taught, teaching level, sex, subject(s) taught, age and location, as well as usage data, including number of visits, sessions, views and downloads of OER in the DDL.

The data collected were entered and cleaned in a customised online database. The data were tabulated and analysed according to their relevance to the three types of impact listed above: access and use, knowledge and practice, and understanding of openness. Different data collection instruments were developed to address these different impacts, with some instruments addressing more than one type of impact (see Table 1). Based on our theoretical framework assumption that impact is reflected in the various stages of uptake (specifically Rogers' [2003] five stages of innovation uptake), the data were analysed to understand the impact of the DDL, using primarily percentage and frequency distributions and disaggregation by variables. From the data, we looked for evidence of impact on teacher subject-area knowledge and teaching practices, such as shifts in instruction.

Data sharing

The quantitative micro data as well as instruments utilised in this study have been published on the DataFirst Data Portal[11] after undergoing a multiphased quality assurance and de-identification process. The research team and the Research on Open Educational Resources for Development (ROER4D) Curation and Dissemination team checked data files for consistency and correctness, whereafter a de-identification process was undertaken utilising an omission strategy.

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11   https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/622

The resulting dataset, published under a Creative Commons Attribution (CC BY) licence, is comprised of seven quantitative data files shared in CSV format, as well as data collection instruments, a dataset description, a project description and a de-identification overview in PDF.

Findings

As stated, this study examines whether OER accessed by school teachers via the DDL enables teachers' use of supplementary educational content in their teaching practice and whether this content positively impacts upon teachers' subject knowledge and pedagogical practice. While the study engaged only a small number of respondents, several datasets were generated to provide numerous angles from which to assess the teachers' experiences in interacting with OER, their responses to OER, and, ultimately, the extent to which they use OER in their teaching and how this affects their practice as teachers.

Teacher use of OER

During the four-week study period, teacher use of OER in DDL increased. On average, the 33 teachers who visited the lab at least three times downloaded 12 OER each over the course of the study. Ten of 18 teachers in the girls' high school downloaded resources, including one teacher who downloaded 23 OER and one teacher who downloaded only one. At the boys' high school, all teachers except for two downloaded OER, including a teacher who downloaded 52 OER and two teachers who downloaded only two OER. The large number of teachers from the girls' high school who did not download any materials (and did not sign in to the library more than once) may be attributed to the fact that women have reduced mobility and increased family burdens that could have prevented them from coming to the lab as frequently as male teachers. At the teacher training college, all nine participants downloaded OER, ranging from 32 resources to one. The high rates of access and use by teacher educators at the teacher training college – many of whom also teach in local schools – suggest that this particular group of teachers is more invested in searching for and using OER.

Most teachers said they had a good experience using OER in the DDL (84% rated the experience as "good", "very good" or "excellent"). However, many teachers continued to rely on the student textbook to prepare lessons. This was despite the fact that 40 respondents stated that they were able to easily discover OER in the library, and 42 stated that they could successfully access resources in the repository; 49 participants stated that they could easily read the content (in terms of font, format, colour). This contradiction may suggest that OER are a deviation from entrenched practices and some teachers chose not to use OER despite having access, perhaps because they are accustomed to using textbooks as the primary information source by which to prepare a lesson. While 20 teachers reported that they used both OER and the textbook, and eight said they mainly used OER from the DDL to design their lesson plan effectively, 23 said they did not use any OER and relied solely on a textbook when preparing their lesson plan. There was no significant variation found in teachers' use

of OER versus the textbook by age, sex, level of education, years of teaching experience or level of comfort using information and communication technologies (ICTs).

Although this study was not designed to measure levels of teacher comfort with ICT, the pre-treatment questionnaire included ICT-related questions as a foundation for understanding teacher practice with technology. It was found that almost all of the teachers in the study owned at least one digital device. However, of those who did own a digital device, less than half (22) had internet access on their device. Of these 22, three said their internet speed was very slow, 15 said it was good or slow, and four said it was very good. Only four participants had email addresses.

All respondents were asked about their level of comfort in using digital devices. The group was split down the middle: six said they were very comfortable and 19 comfortable, while 14 said they were not very comfortable and nine said they were not at all comfortable using digital devices. Respondents were also asked about the frequency of their use of their digital devices (Table 2). Overall, this group of teachers reported a diversity of experiences and comfort levels in using technology, which demonstrates the gradual penetration of technology among teachers, albeit with limitations such as restricted or slow internet access.

Table 2: Teachers' self-reported frequency of digital device use

Device	Use frequently	Use occasionally	Use rarely	Never use
Desktop computer	9	18	4	17
Laptop	5	15	5	23
Mobile telephone	15	8	4	20

The teachers were also asked to rate their experience of using OER in the DDL. Table 3 presents feedback in response to specific criteria in the post-treatment questionnaire. Overall, teachers found the OER relevant: half of the teachers said the OER sometimes met their needs, a smaller portion said the OER always met their needs (32%), while 18% said that the OER never met their needs.

Table 3: Teacher ratings of OER effectiveness in the DDL

Area of application	Always	Sometimes	Never	Total
OER in the DDL generally provided me with more current content than I previously had.	15 (29%)	28 (55%)	8 (16%)	51
The OER I consulted in the DDL extended my knowledge of the topic.	19 (37%)	26 (51%)	6 (12%)	51
The content in the OER I consulted adequately covered my learning and teaching needs in terms of knowledge, skills and conception of the subject.	18 (35%)	24 (47%)	9 (18%)	51
The OER helped me prepare lesson plans.	15 (29%)	23 (45%)	13 (25%)	51
The OER were helpful in creating classroom activities.	18 (35%)	24 (47%)	9 (18%)	51
The OER were helpful in creating assessment activities for my students.	13 (25%)	26 (51%)	12 (24%)	51

Impact of OER on teacher subject knowledge

When it came to expanding teachers' knowledge of a topic, 67% of teachers (34 of 51) said they could identify new topics in the DDL that were suitable for teaching or learning about their subject of interest. When asked if they could relate the new topic(s) in the DDL with the curriculum they taught, 70% (36 of 51) said they could.

The data in Table 3 reflect how teachers perceived the value of OER in the DDL for extending their knowledge on topics taught and helping in lesson preparation. In total, 88% of the teachers indicated that OER in the DDL either sometimes or always extended their knowledge of the topic taught, and 82% of the teachers indicated that OER consulted in the DDL adequately covered their teaching and learning needs in terms of building their knowledge, conceptual understanding and skills on a topic. Increased teacher subject knowledge is also reflected in the improved lesson plans developed post-treatment (74%) and in classroom activities (82%). A total of 76% of teachers indicated that OER were helpful in creating assessment activities for their students, but no improvement in teacher understanding or use of formative or summative assessment of student learning was observed in their pre- and post-treatment lesson plans and during the classroom observation.

Impact of OER on teaching practice

Overall, it was found that exposure to OER in the DDL among the sample of teachers led to improved competencies that are reflective of effective teaching practice.

Lesson plans

Changes to teaching practice were assessed from the scores assigned to the teachers' lesson plan designs before and after DDL training and exposure to OER. Based on the lesson plan rubric, teachers were scored as "effective", "emerging" or "beginner" in key elements of lesson design (Table 4).

Table 4: **Change in teacher lesson-design effectiveness (pre- and post-DDL training and access)**

Lesson plan area of design	Teacher effectiveness level		
What content or skills will the students learn?	Effective	Emerging	Beginner
Pre-treatment and DDL access	16	15	20
Post-treatment	22	14	15
Change	+6	-1	-5
What resources and materials will be used in teaching?	Effective	Emerging	Beginner
Pre-treatment and DDL access	10	24	17
Post-treatment	18	27	6
Change	+8	+3	-11

What teaching method will be used to cover the topic?	Effective	Emerging	Beginner
Pre-treatment and DDL access	15	18	18
Post-treatment	18	24	9
Change	+3	+6	-9

What activities will be used to build student understanding or skills?	Effective	Emerging	Beginner
Pre-treatment and DDL access	5	15	31
Post-treatment	8	17	26
Change	+3	+2	-5

How will student understanding be assessed during the lesson?	Effective	Emerging	Beginner
Pre-treatment and DDL access	9	21	21
Post-treatment	8	21	22
Change	-1	0	+1

The biggest improvement in lesson design was seen in how teachers responded to the question, "What resources and materials will be used in teaching?" Ten teachers scored as "effective" in the pre-treatment rubric and 18 teachers scored as "effective" in the post-treatment rubric; 17 teachers scored as "beginner" in the pre-treatment rubric and only six teachers scored as "beginner" in the post-treatment rubric. It was only with regard to the question on assessment ("How will student understanding be assessed during the lesson?") that no improvement before and after exposure to the DDL was observed. This aligns with the data drawn from the questionnaires and classroom observation, which also suggest that participants struggled with how to assess (or measure) learning in their students. This is a critical area in instructional design where most Afghan teachers need additional support. Overall, there was general improvement in competencies for designing lessons after teachers used OER in the DDL.

Classroom observations

There was no opportunity to do pre-treatment observation of teachers in the classroom, but teachers were observed delivering lessons in the classroom post-treatment by the CW4WAfghan teacher trainers (the same individuals who scored their lesson plans). The trainers scored teachers (n = 33) against the six competencies outlined in Table 5.

Observation of classroom teaching practice during the study revealed that the largest number of teachers were "beginners" when it came to using teaching materials like slides, pictures and handouts to explain the topic (competency 4) and using supplemental (OER) materials to explain the topic (competency 6). This may suggest that, for the lesson being observed, teachers had not yet accessed OER that specifically supported instruction of the topic, or that they had not yet developed the instructional strategies for integrating a variety of teaching materials into the lesson. At the same time, the relatively high number of teachers demonstrating instructional competency in competencies 1, 2, 3 and 5 may reflect the educational and experience levels of teachers in the study (many teachers had a bachelor's degree or a two-year teaching certificate, which is a comparatively high proportion relative to the overall teaching population in the country).

Table 5: Classroom observation results

Competency area	Effective (%)	Emerging (%)	Beginner (%)
1. Learning objectives are discussed at the beginning of the session.	61	6	33
2. Introduction of topic is made clear.	61	15	24
3. Examples, case studies, demonstrations are used to explain the topic.	61	18	21
4. Teaching materials like slides, pictures and handouts are used to explain the topic.	36	24	40
5. Variety of teaching methods and activities are used to deliver the topic.	52	21	27
6. Supplementary materials (OER) are used to explain the topic.	27	33	40

The teachers' improved skills in instructional practice planning after exposure to the DDL was evidenced in improved lesson plan design. It is not clear whether this improvement is due to exposure to OER lesson models in the DDL, the general benefit of the DDL professional training, review or the use of the lesson plan template in creating lesson plans. The research team assumes that a combination of these factors led to improved lesson design and instructional practice.

Impact on awareness of OER

This section examines the teachers' level of awareness and use of OER before and after the DDL training, including their understanding of the qualities and values of openness in terms of educational resources that are open. In the pre-treatment questionnaire, 22 of the teachers said they had used OER before their participation in the study (a context in which they had guided access to OER). However, other responses in the questionnaire demonstrated little familiarity with OER and much confusion about what constitutes OER. Most teachers had some idea that OER generally had to do with information that was online and many respondents assumed that OER had to do with the internet, with libraries, books or information. For example, one teacher responded: "OER means having the internet where we can find any information about anything." Another responded: "OER refers to TV, media, radio, Facebook, Twitter, digital library." Many also specified that they thought OER were specifically resources from *outside* the school: "OER is information other than school books and the information is from the internet" and "OER are books from outside of the school like magazines, newspapers and material from the internet". This perception may relate to Afghanistan's context where schools typically have minimal learning resources besides official textbooks and other kinds of learning materials would, therefore, necessarily have to come from outside of the school.

Several teachers used the word "free" in their responses, but only in one case did a teacher refer to a characteristic of OER that relates to its licensing: "OER means accessing the topics that are not restricted and are free." Several responses also suggested that teachers associated OER with diversifying teaching methods. For instance, one teacher said: "OER is educational trips, doing experiments, showing simulations, playing movies related to the topics, and using the internet and computers." Another responded: "I think OER includes lessons, books, and materials for teaching like a book and board to teach

with." Overall, it was found that OER is largely an unfamiliar concept for these teachers, although they were able to reference some characteristics of OER, such as information that is free, often online and can help teachers diversify their pedagogical practice.

Following training and use of the DDL, teachers were asked about their previous use of OER retrospectively (now that they might have a better understanding of the concept). Of those teachers who said they had previously used OER, the topics and resources they had looked up previously included resources for language learning, computers, full-text materials (such as Rumi's works), Islamic content, family education and topics related to the subjects they taught, including logarithmic equations, atomic physics, letter recognition, inventions of the Wright brothers, Afghan history, blood circulation and texts on speaking, listening and writing. While some accessed videos, most consulted text documents in Microsoft Word or PDF. When asked about the original source of these resources, most simply said they came from the internet or from a Google search, while some said they had come from a CD, library or books. One said she had used an Iranian website, and two said they had previously used the DDL.

Following training, most teachers (76%) said they were willing to share resources found in the DDL with other teachers, and that OER helped them initiate collaboration among students (78%), while somewhat fewer (66%) said OER would help them work collaboratively with other teachers. In total, 60% of the teachers reported that they were aware of how OER in the DDL were licensed, but their grasp of copyright and licensing was unclear.

Generally, the data from the post-treatment questionnaire, post-treatment lesson plans and classroom observations indicate that teachers found OER in the DDL to be relevant, applicable to their classrooms, and able to extend their knowledge of the topics they are teaching. Since teachers' exposure to OER and DDL prior to this study was quite limited, this trend in responses indicates an expected shift from level 1 (*awareness*), to level 2 (*interest*), and level 3 (*evaluation of benefit*), and even venturing to level 4 (*trial and implementation*) in de Hart et al.'s (2015) uptake scale. It also suggests that the localised OER in DDL will be well received by teachers across Afghanistan and may hold potential for positive impact on teacher practice.

Discussion

The study considered impact in three areas: access and use, knowledge and practice, and teacher understanding of the qualities and value of openness. Below, we outline what the findings illuminated for each of these types of impact in the context of teachers' use of OER in the DDL. In addition, the study considered OER as an innovation, and applied Rogers' (2003) stages of innovation diffusion to identify which phase the teachers were at in terms of their adoption of OER, as a change to their normal practice, drawing on de Hart et al.'s (2015) application of this framework to OER adoption. This was considered a relevant and appropriate conceptual framework for this study, given that the introduction of the DDL and open educational content for expanding educators' subject knowledge and teaching practice can be viewed as a "disruptor" and may require a significant shift in thought and practice for many educators who teach in conditions of highly limited access to knowledge resources beyond the government-provided textbooks.

Diffusion of OER among Afghan teachers

Rogers' (2003) theory of diffusion of innovation is useful in enhancing our understanding of the sample of Parwan province teachers' uptake of OER. Based on teacher self-evaluation questionnaires following the study, and the level of OER use in lesson plans and observed teaching sessions within a relatively short period of time, over 50% of the teachers in the study clearly moved from "awareness" to "interest" to "evaluation" in the course of this exposure to OER. Another 25% moved a step further to "implementation", with the remaining 25% demonstrating minimal interest (based on them remaining "beginners" when their post-treatment lesson plans were assessed, and the fact that they made no use of OER in their lesson). This seeming lack of interest could be the result of inexperience or discomfort with technology, the inability to discover OER that supported their teaching, social factors, lack of accessibility to the DDL when visiting the lab, or a combination of factors not yet known or yet to be understood. However, the portion of teachers willing to "implement" OER so soon after their first exposure conveys a positive message in terms of OER uptake and, given the relative newness of using technology-enabled content for learning and teaching, suggests that increased future uptake is likely and may yield positive results in improved teaching.

Some teachers in the study remained resistant to using OER, preferring to depend solely on traditional textbooks. This may be due to the emphasis placed on the textbook in developing countries, where it is often seen as the curriculum and teachers have limited time to seek out, explore and apply other learning resources in their teaching. This is particularly relevant in situations where a large portion of teachers are unqualified or underqualified, and where the state may exert pressure on teachers to work solely with the textbook, rather than trusting them to identify third-party content to teach lessons in the curriculum. Further, the use of high-stakes exams, like Afghanistan's national school-leaving exam, the Kankor, places significant pressure on teachers to teach to the exam and not deviate from the content of the textbook.

Measures required for increased teacher access and use

The need to find ways to make educational material accessible to Afghan teachers and students, and the potential that OER and ICT tools offer in this regard, is clear. To realise the potential of OER to transform educational practice, educators must have consistent and appropriate access to OER in the format best suited for their locale, as well as access to technologies which can be drawn upon or used for innovation under the circumstances. Internet connectivity and limited bandwidth are acute challenges outside of Kabul and in Parwan province where this study was conducted. Installing an offline version of the DDL on decentralised servers worked well, but required staff to periodically connect their personal devices to acquire new acquisitions and updates to the library made since installation. With the exception of occasional power outages that blocked usage of the labs where the DDL was installed, the system worked well, but required repeated visits and improvisation on the part of DDL technical team members to develop a functioning system.

The findings have provided valuable guidance to the DDL team in terms of further developing the library collection to ensure access to relevant resources. Teachers made

it clear that they had a need for more resources in all subjects and that they needed to be able to find topics that suited the curriculum they were working with. The data also showed teachers' continuing reliance on textbooks and, by extension, the importance for DDL resources to be findable with reference to the topics in government textbooks. At the same time, teachers wanted access to information on subjects outside of the curriculum, like philosophy and sports, as well as professional development materials, in addition to resources like lesson plans. In some instances it was found that there was a reluctance among some teachers to prepare lessons using any resources other than the government textbook. The DDL will therefore need to consider activities that can support teachers in learning how to integrate OER into lesson preparation and diversify their information sources.

Quality, localised OER for increasing teacher knowledge and practice

In a young digital library like the DDL, it is not surprising that teachers indicated a need for more content in their subject area, language and instructional level. At the same time, the fact that 66% of the teachers consider that OER in the early-stage DDL provided them with more current subject knowledge than they previously had reflects the dearth of educational resources available to teachers in Afghanistan, and how OER can fill this gap. The adaptation and increased localisation of content into mother-tongue languages to ensure cultural or geographical relevance, improved technical access, and content that reflects 21st-century knowledge and skills will increase the amount of useful educational material in the library for teaching and learning.

OER that model effective instructional methods across core subject areas would be useful. Although there was evidence of modest improvement in the increased use of a variety of OER and instructional methods and activities over the course of the study by the teachers, there continues to be considerable room for growth. Teachers who used the DDL made notable efforts to integrate additional resources and instructional activities into their classrooms, but many teachers' lesson plans were not always aligned to meeting instructional objectives, perhaps because of lack of appropriate resources, the need for additional subject knowledge or factors this study could not determine.

Related to this, one finding stands out as informative: the need to support teachers in their ability to assess student knowledge and skills as a result of their teaching strategies. Within the study, teacher lesson plan designs, post-treatment questionnaire responses and classroom observations all demonstrated a propensity toward "delivering" content rather than engaging students in learning activities and measuring understanding or growth through formative assessment in the instructional session. Curating OER that assists teachers in building formative assessment into their teaching strategies in the DDL could improve teacher effectiveness in terms of the goal of more learner-centred education.

The study's findings suggest that building teacher subject knowledge, integrating a variety of instructional practices and including multiple opportunities for assessing student learning are all critical for effective teaching and learning. As both the quantity and quality of localised OER available to Afghan teachers increases (especially OER that include teaching practices based on student inquiry, critical thinking and problem-based learning), opportunities for teachers to build learner-centred education will grow.

Increasing teacher understanding of "openness"

The concept of openness was largely misunderstood by teachers prior to the intervention, with the concept most often being interpreted as content not provided by the government or resources that are freely available on the internet. The findings of this study clearly demonstrate the need for additional work with teachers to improve their understanding of the value of OER for accessing relevant content created by other educators, and for sharing their own collaborative development of localised content with other educators. At the same time, introducing the concept of OER to rural Afghan teachers is challenging in that framing a description of OER in terms of comparison with "non-open" resources cannot be done as easily as this might be done in other contexts, as intellectual property is poorly understood. In the Afghan context, it appears that OER are not replacing traditionally copyrighted materials; rather, they are supplementing the traditional textbook as the sole learning material teachers typically utilise. Explaining how OER are different from other educational resources is challenging when teachers have little access to either.

Looking ahead

Teachers shared varied and specific recommendations when invited to give suggestions for improving the DDL. Many asked for more resources in their subject, more resources for higher grade levels, resources to be mapped against the Afghan curriculum, pictures and audiovisual resources, resources for teaching student teachers and for an audience of university students, more Pashto resources, resources for new subjects or subjects not in the Afghan curriculum (like sports, psychology and philosophy), as well as information on technology. Several suggestions related to accessibility, such as the need to ensure that the DDL remains accessible offline for teachers, while others asked for internet access or for the DDL to be installed in schools.

More widespread OER adoption, and its consequent impacts, will be realised over a longer timespan than the period observed in this study. That said, the level of teacher receptiveness to OER displayed in the study was highly encouraging, and the teachers' feedback is informative in terms of ongoing development of the DDL, providing guidance on what to prioritise in further development of the collection and what conditions must be in place to facilitate access and impact. In a short window of time, many teachers accepted and adopted OER in their teaching practice, and for those who did, we were able to record an impact on knowledge and practice. Going forward, we hypothesise that the pace at which individuals progress through the stages of OER uptake will vary dramatically, based upon level of localisation and relevance of content, local support structures, available technology, institutional and cultural practices, teacher access to resources, prior knowledge of OER (including an understanding of intellectual property) and the DDL, as well as the willingness (and confidence) of individual teachers to move away from relying primarily on the traditional textbook to build their lessons.

In asking what more can be done to amplify the impact of OER in Afghanistan, our analysis suggests that increased use of OER for both professional learning and teaching will be bolstered by fostering a local community of practice. Further work may consider how to continue to support and encourage the creation, adaptation and reuse of teacher-created

content within the Afghan context. Practice with using OER, including OER creation, can be integrated into ongoing teacher training efforts as one means of further diffusing adoption. In addition, continued development of the DDL collection will need to consider the demands of teachers in terms of the content and support they require – taking into consideration diversified subject matter, format, form and language – to enable further uptake. Access continues to be a key concern, requiring strategies to enable access for teachers within their communities through flexible technical solutions that are responsive to the specific contextual challenges of rural Afghanistan.

Conclusion

This study drew on the experiences of a group of teachers in a particular rural context for whom regular access to OER in their own language was facilitated via the DDL in order to assess whether OER would enable their use of ancillary educational content in their teaching practice. We also asked whether this content would positively impact the educators' subject knowledge and pedagogical practice, and probed the extent to which the teachers could easily use and access the OER, and their understanding of openness. We found impact in terms of utility and relevance for the teachers in helping them make gains in their subject understanding and lesson preparation, and while the teachers had many suggestions for how to make the digital library's OER more useable, a large proportion were able to find and use OER from the library's small collection and apply these resources, registering an improvement in their teaching. While the study could not measure the rate of adoption, given the modest size and scope of the DDL collection, this finding still suggests that there is great potential benefit in amplifying the utilisation of OER in Afghanistan if resources are invested in localising materials, expanding their availability and enabling access to the necessary technologies. Further development of OER could also address areas of particular weakness among Afghan teachers whose practice did not seem to be impacted by their use of OER in the study, such as subject knowledge and use of effective assessment practices, or teachers who opted to continue using only the textbook to plan lessons despite having access to relevant OER and finding it easy to use the DDL.

From the perspective of the adoption of an innovation, OER represents a disruption to a long-held reliance on government-issued textbooks as the main source from which to extract information taught to students, particularly for teachers who lack formal training. A majority of teachers in the study were quick to move through Rogers' (2003) first three stages of innovation diffusion, with a smaller number willing to apply OER in their practice (the implementation stage). This suggests that OER can be assimilated into teaching practice in Afghanistan and that teachers find value in it for supporting their classroom objectives.

This study provides an initial glimpse into Afghan teachers' current awareness of OER, their reactions to a specific directed experience of using OER, and how the experience affected their teaching in terms of impact on their subject knowledge and practice. It is our hope that this initial investigation into localised OER use in a rural Afghan province will assist in providing targeted direction on areas for further investigation and investment in order to enable OER to address the significant and urgent challenges facing the basic education sector in Afghanistan.

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