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World Librarians: A socio-technical system providing library search services to offline schools and libraries in Malawi

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ABSTRACT

World Librarians is a socio-technical system that strives to solve the information access problem many remote offline schools and libraries have in lesser developed contexts. In this Case Report, we describe the system we have developed over the course of three years, where we first establish solar-powered computer labs in remote schools and libraries in Malawi, and then provide them digital information that they want, rather than what we in the Global North think they need. After providing background on these issues, we describe the socio-technical underpinnings and workflow in the World Librarians program. This involves the establishment of “Requester nodes” in the offline schools and libraries, the management of these deployments using a cloud-based WL app, and the operations of the WL “Searcher node” at the University of Massachusetts Amherst, as well as a novel micro-payment system that enables the transfer of large digital datasets through the use of teacher or librarian cell phones and data plans. We close the report with findings from a preliminary survey suggesting that the WL program is making a positive impact on the schools and libraries served. At its core, WL represents a global librarian support system working to remove the barriers to educational information for all global citizens, with central attention and awareness to Global North/South information power dynamics.

1. Introduction

Information access is critical for world development, and the story of William Kamkwamba, a Malawian teenager seeking to improve the life conditions of himself and his family, is a notable data point of what is possible when information is available. In William’s inspiring autobiography, The Boy Who Harnessed the Wind (Kamkwamba, 2010) he describes how in 2002 Malawi was facing a deep drought and famine and how he harnessed scraps of metal, bicycle and tractor parts to create an operational windmill that pumped groundwater to his family’s agriculture field. William describes how he desperately wanted to learn, how his family could not pay the tuition to send him to school, and despite this, he eventually got access to a textbook called Using Energy to obtain the information he needed to develop his ideas, innovate and help save his family. The project we report on in this paper, World Librarians (WL), is directly inspired by William’s experience. Co-author Meyer, co-founder of the information technology ShiftIT based in Blantyre, Malawi, started this nonprofit by asking the question “… if he could manage to change his life just by reading a single book, what could other children do if they had access to technology and a lot more information?” (Weiss, 2018).

World Librarians is a socio-technical system that strives to solve the information access problem many remote offline schools, libraries and health clinics have in lesser developed contexts. Central to the WL program is awareness of Global North and South relationships around the availability of information, and its attempt to provide a system where people who lack access can get access to information they themselves want. In other words, World Librarians facilitates access to digital information by providing library search services to patrons or requesters at offline schools and libraries in Malawi. We are nearing the point where we are ready to expand toward building a much broader WL network with a much larger reach.

In Section 2 of this case we review key issues underlying the idea of this project: (1) the lack of information access faced in many developing countries; (2) recent technical (and costly) efforts to provide Internet access to the world; and (3) the key issue of information power dynamics between the Global North and South. Section 3 describes the socio-technical underpinnings and workflow processes of WL. This involves the establishment of “Requester nodes” in offline schools and libraries, the management of these deployments using a cloud-based WL app, and the operations of the WL “Searcher node” at the University of Massachusetts Amherst. This system has been operational in different
forms since 2016, and over time, we have made technical or social workflow improvements. In Section 4, we report findings from a preliminary survey of the impact of a subset of WL information searches and transmissions to requesters, in an effort to understand if WL is actually making a positive impact to these offline locations. Section 5 closes the paper with some reflections, discussion and perspectives on the future of the program.

2. Background

2.1. The “Digital Divide”

When the term “digital divide” was first introduced, it referenced “…the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities” (OECD, 2001: 5). In other words, it describes the breach that separates people who have material access to the Internet and those who do not (Compaine, 2001). However, over time, the digital divide as a concept evolved as people began recognizing its complexity (van Dijk & Hacker, 2003) leading to a wide variety of justifiable definitions along a variety of dimensions (Hilbert, 2011), including the important focus of ICT use inequality (Jin & Cheong, 2008) and the awareness that there are demographic, geographic and socio-economic dimensions (Yuguchi, 2003). Heeks (2002) observed: “The notion of a digital divide has, in many ways, been unhelpful. It has given too much emphasis to the technology. It has drawn attention away from the other divides and inequalities that hamper development.”

2.2. Information and communication technology for development (ICT4D) and the meaning of “Development”

Over the last two decades – and actually well before that (see, for example Thapa & Saebo, 2014) – literature emerged looking to expand our understanding of these other divides and inequalities (e.g., Loder, 2004), often falling under the label ICT for Development or ICT4D (Heeks, 2007). Generally, ICT4D can be defined as the utilization of information and communication technology in international development contexts to support less materially advantaged members of so-called developing countries (Walsham, 2017). Example research topics on ICT4D include: ICT4D infrastructure construction and service delivery (Meso, Musa, & Mbarika, 2005); human computer interaction in ICT4D settings (Medhi, Sagar, & Toyama, 2007); social aspects of ICT4D settings (Warschauer, 2003; Zheng & Walsham, 2008; Andrade & Urquhart, 2009); specific ICT4D case studies (Nair, 2002); and the evaluation of ICT4D implementations (Kumar & Best, 2006). Core aspects of the evolution of ICT4D as a research program, broadly defined, is a transition from a technical focus to a more socially-oriented perspective (Thapa & Saebo, 2014) as well as ongoing debates over what “development” in ICT4D actually means.

Chipidza and Leidner (2019) provide a recent and extensive review on ICT4D and outline four prevalent perspectives on the meaning of development in the context of ICT4D. The first perspective, “Development as Increased Freedom”, builds on Sen (1999) and the idea of “expanding the real freedoms people enjoy” and the “capabilities to lead the kind of lives they wish to live.” The second perspective, “Development as Expanded Inclusion”, captures original conceptions of the Digital Divide, namely, a lack of Internet access, and the idea of expanding Internet access. Within countries, development as expanded inclusion might focus on addressing gender ICT imbalances, for example tackling the disparities in the number of women pursuing science and technology-related academic programs or even fewer women owning/using digital technologies which limits their access to information. The inequalities might also exist in the dichotomization of social class, especially among the rural versus urban ICT divides. The third perspective, “Development as Improved Well-Being”, captures the idea of development to improve quality of life factors such as increased happiness, improved or expanded educational opportunities, poverty reduction, and improved health and life expectancy. Lastly, the fourth perspective, “Development as Increased Economic Productivity”, captures the scenario where an ICT intervention leads to some increase in production and ultimately, economic output.

In their comparative analysis of these four perspectives, Chipidza and Leidner (2019) note the complexity of ICT4D situations, and that an ICT intervention might succeed along one of these dimensions, while simultaneously hinder the advancement of one of the other dimensions. For example, an ICT4D project with an emphasis on increased (individual) freedom might not necessarily advance the ICT4D as increased economic productivity because the latter focuses more on more aggregated industries and national economies. These authors also conclude that the four development perspectives they present – Freedom, Inclusion, Well-being and Economic Productivity – all neglect the influence of power imbalances on development outcomes. As a result, they present an alternative – and important – “Power Parity Theory of ICT4D,” recognizing that often ICT4D situations are still subjected to the negative effects of relationships born out of colonialism, which we describe next.

2.3. A postcolonial view – the power parity theory of ICT4D

Drawing on language from postcolonial theory literature, Chipidza and Leidner (2019: 153) note that the intended recipients of ICT4D projects are often perceived as somehow “inferior” in terms of social status – the “subaltern” – and the Western donors are viewed as more “mainstream” with access to key resources (e.g., the Internet and information, in our case). This asymmetric power relationship often results in (1) the devoicing of the subaltern, and (2) the dependency of the subaltern on mainstream donors for resources. Similarly, Spivak’s (1988) interrogation of power relations between the West and the South in *Can the Subaltern Speak* highlights the obstructions grounded in a capitalist colonial history that systematically blocks the possibilities of the “subaltern” being heard.

The Power Parity Theory of ICT4D shines light on these postcolonial power dynamics and suggests that development is only successful if “after the execution of an ICT4D project, the subaltern has both resource independence and an effective voice” (Chipidza & Leidner, 2019: 160; our emphasis), and, from our perspective, the independent and effective voice are present from the very start of the project and through the entire implementation phase.

These kinds of power imbalances between the Global North and South exist not only in the context of ICT technology deployment, but also in the context of information or knowledge production (Givarn, 2007) – and the flow of digital information is a key component to the World Librarians program we describe below. This imbalance is characterized by knowledge hierarchies that place Northern knowledge at dominant positions, while the Southern knowledge is often treated as “less important”. A related issue is the argument that the Global North controls and shapes the discourse that takes place in the Global South through the control of media outlets. For example, Chomsky (2002) argues that the concentrated few who control media outlets in the North, selectively choose the issues to be consumed by the masses. According to Chomsky, these are people with power and privilege, and they choose to publish topics that help them to maintain their positions of power. Unfortunately, in academia, patronage networks and prestigious institutions, predominantly housed in the West, continue to have the power of shaping intellectual spaces (Wellmon & Piper, 2017). Even earlier, Foucault (1980) argued that knowledge production is an exercise of power, and people with this power have the ability to not only reproduce knowledge, but to also shape the discourse to align with their agenda. Various agencies continue to control not only the type of discourse the masses can consume, but also the kind of information that is...
(re)produced. According to Magno and Kirk (2008), agencies from the Global North are taking the role of “powerful mediators of information and the construction of knowledge about other parts of the world” (p. 352) without including the voices of those from the South. The intersection of geographical positioning in the South and its colonial history creates a geopolitical space that not only perpetuates a colonial discourse of a monolithic “Other”, but also “empowers” the producers of knowledge hence maintaining an asymmetrical power dynamic (Al-Mahfedi, 2011). This “Us” vs. “Them” narrative, unfortunately, creates an exploitative “exchange” of information rooted in “structural domination and a suppression” (Mohanty, 1988: 333) that systematically silences the voices of the “powerless”.

2.4. A framework for evaluating ICT4D interventions focused on human “informational capabilities”

The perspectives raised in the above literature review highlight the need for ICT4D projects to keep in mind, front-and-center, the goals of establishing resource independence and effective voice. This turns to the question of how to keep those goals front-and-center as an ICT4D project gets established and develops over time.

Gigler (2014) proposes an “impact chain” framework, summarized in Fig. 1, that “separates the overall impact of ICTs on people’s well-being into a five-step process” and elaborates on the conditions under which: access and use of ICTs become meaningful to users; the use is translated into enhanced informational capabilities; and, ultimately, the use improves human and social capabilities” (p. 30). It perhaps best aligns to the “Development as Increased Freedom” perspective described above, but the ideas around power parity can be embedded within it. We find this framework useful in that it provides a series of steps that need to be achieved in order for an ICT4D effort to ultimately become successful.

Step 1 in the chain involves an information needs assessment, with an eye toward understanding their current information and communication needs, key stakeholders, and available communication channels, and based on this evaluation, an effort to establish an ICT infrastructure that is not pushing a technology on the community, but rather, is responding to the real needs of the community. This step also involves the assessment and/or the establishment of ICT infrastructure, such as power, computers or mobile technology, as well as considerations about how these technologies will be supported and maintained. Importantly – and drawing from the Power Parity Theory of ICT4D – keeping front-and-center the idea of ensuring “effective voice” in this and all steps of the ICT Impact Chain is essential.

Step 2 turns to an assessment of the community’s ability to use ICTs within their social, economic, political and cultural situation. In describing this step, Gigler (2014: 30) emphasizes the need to “move beyond the concept of ‘ICT access’ and to study the factors that enable people to use ICTs within their socioeconomic, political, and cultural context. Gigler notes that in many cases the intervention of an intermediary organization can play an important role in assisting the community to acquire basic ICT use capabilities. “There is significant room for reducing digital inequalities through targeted interventions that promote the use of ICTs in rural communities” (Gigler, 2014: 31).

Step 3 in the chain examines the conditions where the simple use of ICTs by a community get converted into a more meaningful use. This involves ICT capacity building, the availability of local and relevant information content, the local appropriation of the technology (e.g., the regular use of the technology by stakeholders), and financial and social systems in place to support the longer-term deployment of the technology. This stage emphasizes the importance of enabling people to utilize ICTs on their own terms, and to allow them to adapt the technologies to their own social and cultural contexts, circumstances and needs.

Step 4 in the chain evaluates the conditions needed to increase a person’s meaningful use of ICT such that they can build personal “informational capabilities” (Gigler, 2014: 33). This concept is complex, and involves the idea of “information capital” defined as the “level of livelihood resources or assets a person has at his or her disposal in terms of information (Gigler, 2014: 23) as well as the idea of “information literacy” defined as “the competencies to recognize information needs and to locate, evaluate, apply and create information within cultural and social contexts” (Garner, 2006). “Information capabilities” builds on information capital and literacy, but adds the concept of human capabilities, drawing on Sen’s ideas that the focus should be on human development, agency, well-being and providing people with the freedom to use ICTs within their institutional, social, cultural and economic settings (Ahmed, 2012).

The final Step 5 in Gigler’s ICT Impact Chain is an investigation to understand how and to what extent meaningful ICT use and enhanced information capabilities leads to enhanced individual capabilities as well as broad societal or collective well-being.

2.5. A focus on steps 1, 2 and 3: technical access to digital information

As we will describe in Section 3, much of our World Librarian program is focused on Steps 1, 2 and 3 of the ICT Impact Chain in Fig. 1 and establishing the ICT infrastructure to enable people without Internet access to digital information. Consequently, some background should be given specifically about this issue.

Increasingly, the diffusion of ICTs – and particularly cell phones – are providing people with greater levels of access to global communications who have not historically been able to get access to the Internet. However, despite this growth, global ICT adoption surveys, like ones implemented by the International Telecommunication Union, report that households in less-developed countries are five times as likely not to have access compared to households in developed settings (ITU, 2017a). In Africa, women’s access to the Internet is reportedly twenty-five percent lower than men, and approximately nine of ten youth between 15 and 24 lack Internet access (ITU, 2017b). Nearly a decade ago, Heeks (2010: 626) observed that “[a]ccess inequalities of location, age, gender, education, and – often underpinning all four others – income, have not gone away. The kids growing up as digital natives’ in suburban Bangalore are far removed from their counterparts
in the ‘bit-less deserts’ of remote rural Africa.”

Organizations have been working at implementing technical efforts to close the lack of access component of the digital divide. For example, Loon LLC, a subsidiary of the company Alphabet, continues to work on high-altitude balloon-based technology to provide Internet access and recently announced a partnership with the first telecom company in Africa, Telkom Kenya (BBC, 2018). The company OneWeb is designing a satellite-based global broadband system, having launched the first six of a planned network of 648 satellites in February 2019 (Henry, 2019).

SpaceX is developing “Starlink” a constellation of nearly 12,000 satellites in a similar effort to bring broadband to the world (Dujmovic, 2019). This idea, however, is not new; people have worked on the idea of a satellite-based Internet broadband for more than 20 years, and these are challenging and costly endeavors (Kelleher, 2017). SpaceX’s Starlink is currently estimated to cost 10B USD (Dujmovic, 2019).

Facebook spent millions of dollars pursuing a drone-based approach called Aquila, only to abandon the project in 2018 (Statt, 2018). While it is possible that one or more of these projects will eventually become successful, the timeline is likely long-term and open ended. Moreover, once a solution is operational, the question will turn to recoup the investment and data plan costs to end users, particularly in developing country contexts. Cellular plans are an example, where Internet access and data plans are nearly ubiquitous now in the Global South, but the cost of unlimited data plans for Internet searching are financially out of reach for many. In short, Heek’s bit-less deserts are likely not going away anytime soon.

Another less costly and perhaps less technologically difficult approach to the problem of lack of access to digital information is to utilize existing satellite technology to transmit one-way digital information to remote receivers similar to what is already done using satellite television (e.g., Direct TV, for example). This more feasible idea and approach was what we started with in an effort to get content to offline schools and libraries, working with an organization that provides an open access multimedia broadcast to small, portable receivers, utilizing existing geostationary satellite networks. But almost immediately, the key question of “who decides what content gets transmitted in that one-way signal?” arose. It brings in the power dynamics described earlier in the discussion of a post-colonial ICT4D. As we will explain, our World Librarians program seeks to provide access to information to people who lack such access, and yet have the voice and the resource dependency questions front-and-center in our activities.

2.6. Background conclusion

In sum, this literature review leads to several important conclusions that help to ground and guide the ongoing development of the World Librarian program presented next.

First, the idea of a digital divide – information haves and have-nots – is more complicated than the early uses of the phrase typically captured. Literature in the area of ICT4D recognized more of these complexities, but often focused on some particular aspect of ICT4D and often not fully placing it in a theoretical lens related to the idea of development.

Second, the review by Chipodza and Leidner (2019) presented four perspectives of the “Development” in ICT4D. Reflecting back to the story of William in our introduction, in the World Librarians program we describe in the next section, there are potential connections to all four of the various development perspectives, but our primary interest fall within (1) Development as Expanded Inclusion (rural offline access to information); (2) Development as Improved Well-Being, with a focus explicitly on improving educational situations; and especially (3) Development as Increased Freedom (providing information to people that they want to expand their own capabilities). The question turns to how we might establish an approach for thinking through the eventual impact of the WL ICT4D intervention with a specific eye on measuring human capabilities, keeping in mind the important power parity dimensions and working to ensure our ICT4D recipients have full voice and we work toward resource independence and informational capabilities as described in Gigler’s (2014) Step 4.

Third, Gigler’s ICT Impact Chain puts attention to efforts to achieve meaningful ICT use, enhanced information capabilities and the goal of enhanced human and social capabilities. This, combined with Chipodza and Leidner’s Power Parity Theory, provides a powerful framework to guide ICT4D projects with the goal of enhancing human and social capabilities in settings where access to information does not yet readily exist, while working to keep in check past power dynamics that are unbalanced and unproductive.

Fourth, much of the World Librarians program we describe in the next section, works to solve the access to information problem found in Steps 1 and 2 of the ICT Impact Chain, however we are also, to some degree, involved in Steps 3 and 4 as well. As we will describe below, co-author Meyer and the organization ShiftIT acts as an in-country intermediary organization assisting local ICT champions in rural offline schools in activities related to Steps 1 through 3. Our WL searcher team at the University of Massachusetts largely supports the “information capital” component in Step 4, but are also seeking to support community growth in the information literacy aspect of Step 4, with the overall goal of building broader information capabilities, and it is at this juncture where we need to be fully aware of global North-South information power dynamics.

3. The world librarians socio-technical system and workflow

The World Librarians socio-technical system and workflow involves three major components: (1) “Requester” nodes – offline schools and libraries in Malawi; (2) The WL App for request node and request management; and (3) a “Searcher” node – a location with staff or volunteers who have access to the Internet. In this section, mapping back to the steps in the ICT Impact Chain in Fig. 1, we describe the technology used in each, and then follow this with a description of how a typical Request-Search-Courier workflow works within this socio-technical system.

3.1. Requester nodes

Our WL process begins with the identification of a potential new offline school or library in Malawi by the ShiftIT team (citation removed) located in Blantyre, Malawi. This team are ICT professionals that live and work in Malawi and understand its culture, its economy, and the on-the-ground dynamics in the country. In the Malawian context, ShiftIT is the intermediary organization that Gigler (2014) describes. A key role ShiftIT plays in the WL process we are now describing, is to identify a school or library for a WL instance, to assess the community information needs, assess factors related to the organization’s potential use of the WL system, set up and then support the stakeholders to get to meaningful ICT capabilities and uses of WL. In other words, ShiftIT undertakes activities related to Steps 1, 2 and 3 in Fig. 1. The initial steps of identifying a school or library to startup is relatively easy. ShiftIT doesn’t readily search for new locations to develop WL programming; rather schools and libraries come to ShiftIT asking for their services. These schools or libraries in Malawi – what we call WL Requester nodes – are typically rural, off grid locations with limited access to electricity and Internet. However, Shift IT also supports some urban and peri-urban locations with similar limitations.

ShiftIT or an associated technical partner, will work with the contact at the school or library to assess the community information needs, as well as an assessment of the ICT technical infrastructure needed and how the equipment will be maintained. Financing for the equipment and installations vary depending on the school or library and the organizations interested in the project. Once financing is established, ShiftIT or a partner will set up solar powered computer labs with
recycled laptops with no hard drives and provide $7 USD Keepod USB-based individual personal computing devices for each end user (Keepod, 2019). With Keepod, each student or library user has their own private computing environment and leaves no data footprint behind on any of the host machines.

At each requester location, ShiftIT installs an offline wifi server called a “Remote Access Remote Area Community Hotspot for Education and Learning” or RACHEL (World Possible, 2019). RACHEL comes operational with a variety of Open Educational Resource content channels, such as Khan Academy, Wikipedia, African Storybook, and many others (OER2Go, 2019). World Possible converts and maintains all Internet URL references so they can operate in an offline fashion. As a result, RACHEL users in these requester schools and libraries immediately have access to a large library of digital resources through wifi access using the Keepod-enabled laptop labs. In addition, the RACHEL wifi device hosts Kolibri (Learning Equality, 2019), a learning management system, that allows teachers to set up courses on the RACHEL that students can access through these Keepod enabled computer labs. Kolibri also provides a cloud-based storage location, and ShiftIT – who enjoy direct Internet access at their office in Blantyre, Malawi – creates a Kolibri channel on the Kolibri cloud, that becomes the mechanism for which new digital information is shared with the school or the library later in the process described below.

At this juncture we should make one important point about the technology used – the RACHEL and the OER2Go database of open access content – and our World Librarians socio-technical system. There are other technical systems that are similar to these technologies, such as the eGranary Digital Library (eGranary, 2020). What distinguishes World Librarians is that in addition to the technology in the field that provides schools and libraries access to open educational resources, we also provide a “librarian services” type of model where users (e.g., teachers, students, library patrons) of the RACHEL can request for information they want that is not already available in the OER2Go database. This request for information function, and social system that supports these requests, is what in part distinguishes WL from other technological solutions like eGranary.

Key to this requester operation, is the training of local teachers or a school computer lab and RACHEL technician to be the technology support person for the school, and typically the school or library’s “requester” in the WL process. ShiftIT undertakes these trainings and acts as the intermediary organization that provides backup support when technical problems occur.

As of this writing, ShiftIT has deployed over 1000 keepod PCs at over 30 offline school or library locations, and have trained over 100 local teachers on the use of the technology (ShiftIT, 2020).

3.2. The world librarian app for node and request management

The World Librarians App (WL App) is a cloud-based management system built through a partnership with Salesforce (Salesforce, 2019). The App serves two purposes. First, ShiftIT uses it to manage their Requester node deployments. Second, the WL Searcher Node team uses the WL App as a Request Case Management System.

Anytime a Requester node transmits a request for content via a Twitter message to the University of Massachusetts Amherst Searcher node (@WL_UMass; see Section 3.3), a “Conversation” is automatically created in the WL App cloud-based database. But in order for this to occur, Requester and Searcher Twitter handles and organizational information must be first whitelisted2 in the WL application. Currently the only active Searcher Node resides at the University of Massachusetts Amherst and consequently all requests are sent to the @WL_UMass Twitter handle. Sometimes tweets received are not content requests, and therefore, a World Librarians request “Case Manager” of the UMass team verifies through the WL App if a given tweet message is deemed to be an information request or not.

At the Searcher node, when a new tweet conversation is initiated, and the request judged to be valid, the Case Manager creates a “Case.” A Case is an accepted request and serves as the initial point of information for a given search request. From here, more information can be added to the Case and is historically logged to keep track of the progress of a request. Each Case is assigned in the WL App to a World Librarians searcher team member and they become responsible for finding relevant open access material (video, text, etc.) for that request. If there is further request clarification communication between a Requester and the Searcher team over Twitter, that information is stored in the same Case.

Given the UMass Searcher node now manages multiple – and sometimes many – requests at one time, the WL App has become essential for researcher management. The cloud-based nature of the WL App means that as WL continues to expand its reach to new Requester schools and libraries, we are set to also expand and create other Searcher nodes – an important point we will return to in Section 5 that relates to the earlier discussion of post-colonial power parity.

3.3. Searcher node(s) and the request-search-courier workflow explained

As stated earlier, the current WL searcher node resides at the University of Massachusetts Amherst and is composed of students and led by two UMass employees (co-authors Schweik and Smith). This team is connected to UMass Amherst Libraries under their Scholarly Communication office, which provides campus guidance on issues surrounding Open Educational Resources (OER) and open access copyright licensing (e.g., Creative Commons). This expertise is key to World Librarians, for in order to share digital resources to requesters, the licenses must permit redistribution.

Fig. 2 summarizes the entire WL workflow, technologies, and process steps. As mentioned previously, the search process begins when a Twitter message request is sent from an offline requester school or library (see sections 3.1 and 3.2). This request tweet, sent with a reference to the UMass WL Twitter handle @WL_UMass is automatically entered into the WL App database as a Conversation (Step 1, Fig. 2).

The WL Search Manager at UMass, on a daily basis, checks the WL App for any new requests from any of the requester nodes we support (Step 2, Fig. 2). When a new request comes in as a Conversation in the WL App, it is verified as a request, and if legitimate, the WL Case Manager assigns it as a Case and directs a WL Searcher team member to look for appropriate content (Step 3, Fig. 2).

The assigned WL Searcher team member for the particular request undertakes an online search for the digital content requested (Step 4, Fig. 2). We provide a variety of open access formats (video, articles, textbooks) but video is often preferred, since some requesters in Malawi (such as younger school children) may have difficulty reading English but can understand the spoken audio. Some of the main Open Access online repositories we use are listed in Table 1.

Once the WL searcher finds relevant material, they upload the content to a Google Drive folder and notify both the WL Case Manager and our in-house Open Access Librarian, who conducts a quality assessment of the content and double-checks that the contents’ copyright license permits redistribution (Step 5, Fig. 2). Upon approval, the WL

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1 For example, one of our favorite examples is a request we received from students at Saint Michael’s School in Malawi, who requested our WL search team to find (paraphrasing) “information on how to get a helium balloon into space.” Our team found videos and other digital content for them on this, including information about airspace safety, that we transmitted back to them through the workflow described in the next section.

2 The term “whitelist” is a technical term used to describe a situation where a user id (e.g., email address, domain name, etc.) is recorded in a database so that a system knows they are a valid user of the system.
Case Manager is notified that the content is ready to transmit.

With this go-ahead, the WL Case Manager undertakes three activities. First, they move the digital content from the UMass librarian review folder on Google Drive, to the school or library “transmission” Kolibri channel on the cloud that ShiftIT created when the Requester node was established (see Section 3.1) and our Requesters in Malawi (Step 6, Fig. 2). These folders are explicitly named after Requester nodes and are accessible to the “Couriers” (usually a teacher or librarian) at the Requester nodes through their cellular data plans.

Next, the WL Search Manager calculates and submits a digital payment via the World Remit (2019) system to the Courier to cover the download cost – typically a teacher or a librarian using a personal smartphone and data plan in Malawi (Step 7, Fig. 2). This is “digital postage” that the Searcher team pays to reimburse the Courier for “air time” used on their Airtel data plan (Step 8, Fig. 2). This World Remit digital postage invention is a key innovation for the WL program, for the downloading of data via a teacher or librarian cellular plan is critical to making this work. For this reason, we provide more information on this in Box 1 and 2.

Box 1. The “digital postage” scheme: Courier payment via World Remit
The average single request data transaction size based on World Librarians historical data is 812 megabytes, so the estimated Digital Postage Stamp associated with a single transaction is approximately (at the time of this writing) 5,419 MWK or about $11 USD. On average over the last year, our UMass World Librarians Searcher team, supporting 10 schools and libraries, sees about two requests per month. Based on that figure, we estimate a yearly digital postage stamp expense of approximately $220 USD (see Box 2).

In 2019, we ran our first Courier payment using the online payment platform World Remit (2019), which operates in Malawi (and many other countries). A helpful feature of this system is that it allows us to add funds directly to the Courier’s data plan via World Remit’s “Airtime” feature. To do this, the WL Searcher team lead uses a university-based purchasing credit card to make direct micro Airtime purchases. Ultimately, we hope to make this payment an embedded function within the WL App.

Box 2. Funding the “digital postage”: Crowdsourcing at a university using a student-run WL club
At UMass Amherst – like most universities – there are university sanctioned Regist ered Student Organizations (RSOs). At the time of this writing, we are in the process of establishing a World Librarians RSO at UMass, where the students affiliated with this club will have two primary responsibilities: (1) they will be taught how to search for open access digital content and will act as part of the Searcher team; and (2) they will be tasked with collecting donations to support our digital postage payment system. Students readily want to participate as searchers for World Librarians, in part because they are attracted to the public good that WL provides. We expect this WL RSO to be fully operational in our next academic year at UMass.

Second, like many universities, UMass Amherst has a crowdfunding platform available for RSOs and other groups to collect funding to support student activities. At UMass, this crowdfunding program is called the “MinuteFund” (UMass Amherst, 2019). Other universities also follow this model, suggesting that if we expand searcher nodes to other universities, they can follow a similar mode. For example, the University of California San Francisco has a crowdfunding program called ‘The Campaign’ (UCSF, 2019) and the University of Mississippi has both a crowdfunding program called ‘ignite Ole Miss’ (“ignite Ole Miss”) and a day of
Box 2. Funding the “digital postage”: Crowdsourcing at a university using a student-run WL club
giving called ‘Ole Miss Giving Day’ (University of Mississippi, 2019). All of these programs use Scalefunder (2019) as their crowdfunding platform. This platform allows for smaller groups on campus to raise funds at any time of the year.
A primary goal of Academic Year 2020–21 at UMass will be to raise funding to support digital postage to reimburse Couriers through the World Remit (Box 1) payment system.

After digital postage is sent to the Courier via World Remit, the WL Search Manager notifies the Requester via Twitter that the content is available in their Kolibri channel on the cloud (Step 9, Fig. 2).

Finally, in most instances, the Courier at the Requester node downloads the content via their smartphone’s data plan and then uploads the information to the RACHEL system for use by students or library patrons. The Courier should also let individual requesters in their organization know this digital content is available (Step 10, Fig. 2). Ideally, the Requester will finalize the process by either tweeting the searcher team that the content sent satisfies their request (not depicted in Fig. 2), or submits a new search request (Step 1, Fig. 2) with more clarification on the content they are requesting the UMass team to find.

4. Preliminary results from three years of operation

World Librarians has been under development and refinement for approximately four years and we estimate that over that time period the UMass Searcher team has responded to approximately 250 different requests from our Malawi requester nodes. To get preliminary information on the educational impact of the World Librarians program on the patrons (student learners, library patrons) of requester organizations, ShiftIT staff implemented a survey in Malawi which specifically asked about transactions made between the most recent half-year – April 2017 to September 2018 – where memory recall for respondents would be easier. We asked specific questions about individual requester-search results or topics and the utility of the material we transferred, and also meta-level questions about the school or library’s overall experience across multiple requests-search cycles on the impact of the World Librarian program.

For the 23 specific request-search transactions, we asked: “In the past, you requested information on: “[specific topic they asked provided here].” How helpful was the information we sent you for you and your students or patrons?” The mean score to the Likert scale question of “of 0 (not helpful) to 3 (extremely helpful)” was 2.52, with a median value of 3. This suggests that the vast majority of content (video, text or pdf) shipped in response to requester’s requests during this period was helpful.

We also posed a set of questions to the requester asking them to specifically reflect on the World Librarians program as a whole, rather than focusing on individual content requests. Of the ten requester organizations we surveyed, eight agreed or strongly agreed that their students or patrons are showing learning improvements as a result of receiving World Librarians transmitted material. Of the two respondents who reported no learning improvements, they suggest the reason is not the WL system, but rather limited access to technology for students or patrons to use to access the RACHEL system. We closed the survey by asking requesters about the likelihood that they would make future content requests. All 10 respondents reported that they would likely do so.

Finally, in a recent interview by one of the requesters, a physics teacher with Saint Michael’s Girls Secondary School – one of the longest participating schools in the WL program – provides additional support that the WL system is making a positive impact. “It has assisted in my teaching career so much,” he says. “It has made lesson delivery easier than before. The school has also benefited quite a lot from the World Librarians. Using the information, students have performed outstandingly during national examinations, and the school emerged as the 2018 champions in the nationwide Malawi Broadcasting Corporation’s Top of the Class Quiz Competition.”

While these results are only preliminary and are not a result of a formal, scientific and quantitative evaluation on WL impact on requester organizations, they are encouraging. We are actively designing a formal evaluation study at the time of this writing.5

5. Discussion and conclusion

World Librarians is an effort to provide information to people (teachers, students, librarians, patrons, health care workers) who live and work in areas of the world where Internet access is not available. Central to this program is awareness and attention to information power dynamics between the Global North and South, and an effort to assist information have-nots by providing information they want and not what we in the Global North think they need. Simply put, the socio-technical workflow we just described is one of the library patron and the librarian, where the librarian – who could be halfway around the world – is simply assisting the patron find what they want. This said, this is only a first step toward achieving more Global North-South power parity around information provision. We recognize that our search team at UMass do not specifically know the local context or culture in Malawi – other than what we are told through our connections to ShiftIT or our requesters – and consequently we have not yet reached power parity (we return to this topic below).

We are now in our fourth year of operation of WL, and have devised solutions to some of the most critical issues in order to make this a completely operational system. The implementation of the “digital postage” payment to data couriers using the World Remit system, is an example of one of the critical innovations we had to devise to make the socio-technical workflow fully operational. The development of the WL App for requester and searcher node management is a second. Preliminary survey data that suggests that WL is deemed useful by the requesters or patrons World Librarians is trying to serve. Over the next year, after the Covid-19 pandemic subsides and schools return back to some level of normalcy, we hope to complete the administration of a scientific, empirical evaluation of World Librarians to confirm this conclusion.

Returning to the ICT Impact Chain discussion described in Section 2 (Fig. 1), we want to remind readers that ShiftIT, the intermediary organization on the ground in Malawi, undertakes Steps 1 through Step 3 as outlined in the ICT Impact Chain discussion described in Section 2 and depicted in Fig. 1. For any new deployment of the WL socio-technical system, ShiftIT, working with local school officials: (1) assesses their information and technology needs (Fig. 1, Step 1); (2) assesses factors related to people’s ability at the particular school or library to use ICTs, namely the technical systems we use such as Keepods, PCs, the RACHEL wifi, the Kolibri LMS, Twitter, etc. (Fig. 1, Step 2); and (3) examines where the simple use of the WL ICT system (e.g., Keepod,

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3 In a few WL deployment instances where there is no person with a smartphone available to download data, the workflow is different, using a process of ShiftIT staff downloading to a USB stick and a transfer to a laptop for uploading to the RACHEL.

4 Over the years, researchers have argued over the utility of descriptive statistics, such as the mean and standard deviations, for analysis of Likert scales survey responses (e.g., what does the average of never, or “rarely” really tell us?) (Sullivan and Artino, 2013). However, one comprehensive review by Norman (2010) concludes that parametric tests are appropriate and can be used to analyze Likert scale responses.

5 We were in the process of implementing a more formal, scientific evaluation of the impact of WL during Spring 2020, and we had surveys deployed to the schools in Malawi. Unfortunately, the pandemic brought these efforts to a halt and we are waiting to administer again after things return back to some level of normalcy.
An important new innovation that we have just begun to use is more direct needs, but there are still limitations and power dynamics in play as the UMass team that the material transmitted does or does not match their request helps, where they can communicate to the Global North-South information power inequities. Direct communication about post-colonial ICT4D and issues of power parity, we recognize that we have not fully achieved parity yet. While we – the searcher team nodes in the requester country who have Internet access and have Internet access. But one other possibility would be to reach out to a network of retired librarians, world-wide, who might be interested in using their information management skills to help people in other parts of the world who lack information access. This idea raises the issue of Global North-South power dynamics again. Such an expansion would need to be carefully administered as another loose intermediary organization, acting in an advisory role to search teams established in Malawi and available when needed.

In conclusion, after four years of effort, the World Librarians program is fully operational. It represents a global librarian support system working to remove the barriers to educational information for all global citizens, with central attention and awareness to Global North/South information power dynamics. We are now in the process of trying to establish similar WL instances in Haiti, Kenya, and Cameroon. We would welcome readers of World Development Perspectives – especially readers in these countries as well as Malawi – to contact the authors if interested in helping to grow the WL program.

CRediT authorship contribution statement

Charles M. Schweik: Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft, Supervision, Project administration. Carl Meyer: Conceptualization, Writing - review & editing, Project administration, Funding acquisition. Pempho Chinkondenji: Writing - original draft, Writing - review & editing. Jeremy Smith: Project administration, Writing - review & editing. Promise McHenga: Project administration, Writing - review & editing.

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References

Ahmed, M. A. (2012). Technology Choice in Aid-assisted Parliamentary Strengthening Projects in Developing Countries: A Capability Approach. In I. Oosterlaken & J. van den Heever (Eds.). The Capability Approach, Technology and Design. New York: Springer.

Al-Mahfidi, M. H. (2011). Edward Said’s ‘Imaginative Geography’ and Geopolitical Mapping: Knowledge/Power Constellation and Landscaping Palestine. The Criterion: An International Journal in English. 2(3), 1–26.

Andrade, A. D., & Urquhart, C. (2009). The Value of Extended Networks: Social Capital in an ICT Intervention in Rural Peru. Information Technology for Development, 15(2), 108–112.

BBC. (2018). Google’s Loon brings Internet-by-Balloon to Kenya. Retrieved from https://www.bbc.com/news/technology-44886803. Accessed 7/18/2019.
