Journal of Refugee Studies Vol. 0, No. 0
doi:10.1093/jrs/feaa040

Education for Humanity: higher education for refugees in resource-constrained environments through innovative technology

CARRIE BAUER

Arizona State University, Education for Humanity, Scottsdale, Arizona 85257

MATTHEW J. GALLAGHER

Arizona State University, Education for Humanity, Scottsdale, Arizona 85257
mgallag9@asu.edu

MS received November 2019; revised MS received April 2020

Half of refugee children attend primary school and 22 per cent attend secondary school, yet only 3 per cent have access to higher education. When higher education efforts do exist, they often ignore common barriers refugees face in accessing it: cost, connectivity, lack of a power source, and access to devices, among others. Arizona State University's Education for Humanity team piloted a programme to address this lack of access and associated barriers. Using a solar-powered, offline technology that emits a Wi-Fi hotspot, the team implemented a university-level course in Nakivale Settlement, Uganda. This article presents the results and findings from this pilot programme.

Keywords: higher education, refugees, displaced persons, barriers to accessing education, online learning, offline technology

Introduction

At the end of 2018, 25.9 million refugees had moved across borders to flee war, persecution, and other atrocities, with roughly half being children (UNHCR 2019a). While humanitarian efforts have traditionally focused on 'immediate' needs such as food and housing, education remains ill-addressed. Recent landmark agreements, such as the Comprehensive Refugee Response Framework (2016), Djibouti Declaration on Refugee Education (2017), and the Global Compact on Refugees (2018), have brought education to the forefront of the refugee crisis. However, while half of refugee children attend primary school and 22 per cent attend secondary school, only 3 per cent of refugee children have access to higher education and only 1 per cent enter the higher education pathway (Save the Children 2017; UNHCR 2018). In comparison, 36 per cent of global youth have access to higher education (UNESCO 2017).

When higher education efforts do exist, they are often implemented in formats that ignore the common barriers refugees face in accessing higher education, such as cost, technological infrastructure, connectivity, electricity, and access to devices, among others (Farmer and Boots 2013; Dahya 2016). While attempts have been made at solving these issues, a sustainable solution for delivering high-quality, higher education options that addresses these barriers at scale for this population still does not exist (see MacLaren 2010; Purkey 2010; Crea and McFarland 2015; Crea 2016; Kirui and Osman 2016; Crea and Sparnon 2017; Reinhardt *et al.* 2018). In an era where refugees face an average displacement time of 26 years (UNHCR 2016a), it is imperative that higher education is made a critical component of emergency response policy and that research focuses on finding sustainable and scalable ways of meeting these needs. At the recent Global Refugee Forum in Berlin (June 2019), UNHCR, the German Federal Foreign Office, and the German Academic Exchange Service (DAAD) encouraged all conference participants to commit to increasing refugee participation in higher education from 1 per cent to 15 per cent by 2030 (DAAD 2019; UNHCR 2019a). To meet this ambitious goal, programme solutions must address the existing barriers to doing so.

Within this context, Arizona State University's (ASU) Education for Humanity team designed and piloted a programme solution from April to July 2019 to address this lack of access and associated barriers. Named 'Education for Humanity: Powered by SolarSPELL', the programme solution uses a solar-powered, offline technology that emits a Wi-Fi hotspot. Using this technology, the Education for Humanity team implemented a university-level course with Windle International Uganda in Nakivale Settlement, Uganda. Thirty students were recruited to participate in the course, two local facilitators were contracted to provide daily programme oversight and classroom management, and an ASU-based agribusiness professor provided content and assessment expertise. During implementation, the study's research team assessed the ability of the programme solution to deliver the course in the resource-constrained environment of Nakivale settlement. The study also assessed the extent to which the programme solution addressed the barriers to delivering online higher education to resource-constrained communities: cost, connectivity, power source, and access to Internet-enabled devices.

This article first explores the current context of refugee higher education, including the benefits of participation and the barriers facing refugees who wish to access it. It then provides a description of the innovative technology solution designed by Arizona State University to address these issues. The article then presents the results and findings from the implementation of a university-level course in the resource-constrained environment of Nakivale settlement in southern Uganda. The article concludes with a discussion of the findings and the important precedent the programme solution sets for extending higher education access to refugees living in resource-constrained environments.

Refugee Higher Education: Critical Need and Benefits

The need for higher education (e.g. universities, vocational schools, community college) is critical worldwide. Global enrolment in higher education is expected to reach over 594 million by 2040 (ICEF Monitor 2018). While humanitarian efforts have focused on refugee primary and secondary education, a gap in global higher education policy remains (Dryden-Peterson and Giles 2010), evidenced by limited university attendance (Save the Children 2017). Research attributes the lack of action from donors and government agencies to refugees having such low access to primary and secondary school that higher education would only benefit a small, elite group at great cost (Dryden-Peterson 2012). Research has also noted drawbacks to the provision of higher education to refugees. Issues of colonization and development by foreign entities that do not consider cultural sensitivity or community needs have often plagued access to higher education for refugees (Donald 2014).

Despite this, 'refugees are clear that progression to higher levels of education is integrally connected with their future livelihoods and stability for their regions of origin' (Dryden-Peterson 2012: 11). Higher education provides refugees with the identity, confidence, knowledge, and skills necessary for transition into the ever-expanding knowledge-based job market (O'Sullivan 2002; Crea 2016) and allows them to become leaders, instructors, and/or tutors within their communities (Dankova and Giner 2011). Moreover, it creates identity for youth and mitigates young people's involvement in conflict. It helps identify and establish human and social capital and can help with 'future reconstruction and economic development in country-of-origin' (Gladwell et al. 2016: 14; World University Service of Canada (WUSC) 2018). Higher education has been linked to the advancement of individuals, communities, and entire nations.

Furthermore, the presence of higher education opportunities helps improve primary and secondary completion rates and acts as a '"pull factor" for students in lower grades, encouraging them to stay in school' (World University Service of Canada (WUSC) 2018: 5). For example, Iraqi refugees in Jordan who completed secondary school almost universally voiced a desire to attend university (Women's Refugee Commission 2009). Studies from Chaffin (2010) and Perlman-Robinson (2011) have also demonstrated that limited or non-existent access to higher education decreases motivation among young people to persist in primary and secondary schools. Conversely, when access does exist, it is linked to improved primary and secondary completion rates (Gladwell *et al.* 2016). Overall, refugees' demand for access to higher education is a critical need based on numerous known benefits.

Refugee Barriers to Higher Education

As established, refugees have limited access to higher education. There are a considerable number of barriers that exist—both theoretical and technical—that hinder refugee learners' ability to begin and successfully complete higher education pursuits. From a theoretical perspective, participation in higher education connotes a long-term situated process, while refugees' statuses are seen as temporary (Zeus 2011; Naylor et al. 2019). In addition, institutions of higher education operate within the existence of the nation state, which deems granting refugees access to higher education problematic since they are 'nation-state-less'; finally, since refugees are seen as dependent upon foreign aid, they are viewed as being 'incapable of dealing with the challenges of higher education' (Zeus 2011: 261). From a technical perspective, refugees face a lack of required resources about opportunities in higher education: the high cost of fees, tuition, and international student fees; a lack of required documentation associated with university applications such as birth certificates, school diplomas, and examination results; interrupted education (Naylor et al. 2019); difficulties associated with English as a second language (Donald 2014; Gladwell *et al.* 2016); and issues with access to a network connection, power sources, and Internet-enabled devices (Dankova and Giner 2011; Dahya 2016; UNHCR 2016b).

The Education for Humanity: Powered by SolarSPELL programme recognized, took into account and addressed many of these issues (i.e. opportunity; cost; documentation; interrupted education; English language). The scope of this article will focus on the technical barriers of cost, connectivity, power source, and access to devices as related to the research question of whether the designed technology solution could deliver a university-level course in a resource-constrained environment. We have outlined these barriers and their ramifications in more detail below. In addition, each of the recommendations made to address these barriers abide by and adhere to the Quality Guidelines issued by the Connected Learning and Crisis Consortium, which aim to improve the design and quality of refugee education programmes (Connected Learning in Crisis Consortium (CLCC) 2017).

1. *Cost*. Traditional face-to-face higher education programmes are often too costly and logistically challenging to carry out successfully in communities affected by displacement (Anselme and Hands 2012; Dryden-Peterson 2012; Donald 2014; Dahya 2016; World University Service of Canada (WUSC) 2018). In higher education settings, the costs of curriculum development, professor salaries, and classroom space are typically passed on to the learners. Technology can lower some of these costs, including the elimination of classroom space, transportation costs, and the need to schedule professors due to asynchronous learning. However, while technology offers a more cost-effective solution, communities affected by displacement are typically low-resource environments—i.e. environments where technology is difficult to implement. Any refugee higher education initiative that utilizes technology to increase access must also have low implementation costs. For learners, the cost for access needs to be free or as close to free as possible.
2. *Connectivity*. While broadband Internet continues to increase its coverage area, communities affected by displacement still lag behind (Dankova and Giner 2011; UNHCR 2016b; World University Service of Canada (WUSC)

2018; Pherali and Moghli 2019). These places frequently lack digital networks and infrastructure, or the cost of connectivity is prohibitive. While urban refugees have similar Internet and mobile network coverage as the rest of the world, refugees living in rural locations are more likely to have less coverage and less access than the communities around them. Indeed, 20 per cent of rural refugees have no network coverage at all (UNHCR 2016b). Where networks do exist, refugees struggle to afford connectivity but still buy data with the scarce means they have, though strictly limiting their usage. To implement a higher education programme that utilizes an online learning approach, connectivity must be readily available and, ideally, free of charge.

3. *Power Source*. Displaced communities in rural locations typically have significant problems accessing electricity (Pherali and Moghli 2019). Rural refugees are less likely to have access to the power infrastructure than the communities around them and when they do it is often intermittent (UNHCR 2016b). Any higher education initiative must take into account that free, stable and easy access to electricity is essential if refugees are to remain connected.
4. *Access to Internet-Enabled Devices*. Delivering online higher education via Internet-enabled smartphones or tablets eliminates the costs and space needs associated with desktop computers. However, smartphone ownership presents a challenge, with refugees almost half as likely as the general population to own an Internet-enabled phone and approximately 2.5 times more likely to be living without a phone altogether (UNHCR 2016b; Pherali and Moghli 2019). Any higher education initiative must also take into account that online learning is dependent upon learners having access to Internet-enabled devices.

Using Technology to Increase Access to Higher Education

While there are barriers that limit refugees' access to higher education, research indicates that using technology can increase access. Advancements in technology, such as increased broadband Internet coverage and availability of Internet-enabled devices, have increased the demand for higher education among refugees (Ally and Tsinakos 2014). To meet this demand, development organizations and universities have begun to explore the potential of using technology to increase access to education (Connected Learning in Crisis Consortium (CLCC) 2017).

Dahya (2016) notes that technology offers great possibilities as a tool to support, facilitate, and enable access to quality education in difficult-to-reach areas. For higher education, online courses offer education opportunities to communities that have historically been excluded from formal learning systems, such as refugees in protracted living situations that have limited mobility (Burns 2011). For example, in 2010, the Jesuit Commons: Higher Education at the Margins programme operating in Kenya, Malawi, and Jordan, provides an accredited programme of study via the Internet leading to a diploma with an official transcript through Regis University (45 credits); as well as a Community Service Learning track that provides other workplace competency courses through online education delivered in the camps (Crea 2016).

Technology has also increased refugee access to higher education through Internet-enabled devices. The opportunity of learning online via an Internet-enabled device is highly relevant to this population, as it recognizes that 'learning should not stop as people move, and that people on the move are focused on continuing their education' (Dahya 2016: 5). Mobile phones can be used to access courses via offline applications or to download course information and study it at home. However, 'technology is [also] creating new and sometimes unexpected opportunities for pathways to education for refugees' (Dahya and Dryden-Peterson 2017: 2). An example is what Kekwaletswe (2007: 105) refers to as 'knowledge-sharing spaces', where learners in online social network communities are using mobile devices in South Africa so that they can access and pursue higher education.

Furthermore, technology has been shown to increase accessibility to higher education because of its flexibility, including targeting more learning styles and preferences (Means et al. 2009), better fitting learners' schedules, and allowing time for learner reflection (Burns 2011). This has resulted in an increase in popularity of online and blended learning among refugees (Latchem and Jung 2010).

While programmes have used technology to increase access to higher education, their ability to replicate at scale and remain sustainable has been difficult, including challenges of having programmes built for multiple types of devices, having technology account for blended learning styles, and having stable Internet and electricity to support technological solutions (Dahya 2016; UNHCR 2016b; Reinhardt 2018). As Dankova and Giner (2011: 11) stated in their research, 'It is a daily challenge to ensure smooth operation without power cuts due to technical problems or breakages'. As such, the programme solution presented and discussed in this article has endeavoured to address these issues, fill the gap of knowledge on how to address these technical barriers, and create a sustainable and scalable solution.

Education for Humanity: Powered by SolarSPELL Programme

From April to July 2019, Arizona State University's Education for Humanity programme implemented the university-level AGB250 Agribusiness: Economics of the Allocation of Resources course with Windle International Uganda in Nakivale Settlement, Uganda. Thirty students were recruited to participate in the course, two local facilitators were contracted to provide daily programme oversight and classroom management, and an ASU-based agribusiness professor provided content expertise and graded all quizzes and tests.

The choice to implement an agribusiness course arose from a series of needs assessments led by Education for Humanity staff in refugee camps, settlements, and urban centres in the Middle East and Eastern Africa. Based on a consensus of requests, Education for Humanity proposed an agribusiness course to its humanitarian organization partners and their refugee constituents. Of the various places it was offered as a potential programme for partners, it was embraced as a much needed educational offering in Uganda. The course was particularly well-suited to potential learners in southwestern Uganda, where the landscape lends itself to agrarian success; the government of Uganda provides land to refugees for agricultural development and complements the already existing vocational training activities of Windle International Uganda at Nakivale Vocational School. In addition, Uganda, as a member of the Intergovernmental Authority on Development (IGAD) and co-signatory of the Djibouti Declaration on Refugee Education, has one of the most inclusive regional frameworks for improving refugee livelihoods through the provision of education (IGAD 2017). Based on this situation, efforts to build the course and updated course delivery technology commenced in February 2018 and were completed in March 2019.

To best reach the 30 learners selected for the course, students accessed the course content via Arizona State University's updated SolarSPELL technology. SolarSPELL was originally designed as a portable, solar-powered digital library for use in resource-constrained locations. Its digital library provides locally relevant, open-access, educational resources to learners by emitting an offline Wi-Fi hotspot to which any Wi-Fi-enabled device within a 50-foot radius can connect. By doing so, the SolarSPELL mimics an online experience to help build learners' information literacy, technology, and digital learning skills in a safe, offline environment.

To host a university-level course, a technology team was formed to update the existing SolarSPELL technology. The team added a learning management system (LMS) to the technology, enabling the SolarSPELL to deliver complete courses to remote areas and thereby greatly increasing its potential. The new technology, named 'Education for Humanity: Powered by SolarSPELL', consists of a Raspberry Pi computer with both the digital library and the Moodle LMS to run the agribusiness course. The Raspberry Pi was configured to run on Nginx, a faster and lighter software than the previously used Apache, thereby allowing the SolarSPELL to better handle the multiple requests indicative of an online university course while using minimal resources. In addition, the operating system was updated to Raspbian Jesse Lite over the previous Raspbian Jesse to take up less space on the SD card and use less electricity. Overall, the new E4H: Powered by SolarSPELL technology now runs faster and more efficiently, despite containing both an LMS and a digital library.

To add a course to the new technology, the team approached Dr Jeff Englin, who taught the course 'AGB250 Agribusiness: Economics of the Allocation of Resources' to Arizona State University's online students. The publisher of the textbook utilized in his course did not grant copyright permission for the book's content to be placed on the new technology. This led the team, including Dr Englin, to find an open-source textbook that could be revised to fit the needs of learners. The course team revised the content to be more culturally relevant, added pertinent supplemental articles, and simplified some of the English terms used. When doing so, the team used only open-source articles, photos, and videos.

In addition, the team built the course using a 95/5 model where 95 per cent of the course material would be accessed offline via the SolarSPELL and 5 per cent would be accessed online via a network connection and messenger service. For this pilot, the 30 students were provided a total of 12 devices (6 laptops and 6 tablets) to share. Once connected to the SolarSPELL Wi-Fi, the learners would either download course content to their device or to the offline Moodle application so that it could be reviewed when not connected to the SolarSPELL Wi-Fi. During the 5 per cent online portion of the course, students would submit assignments, take chapter polls, and receive feedback from the course professor via two data cards and smartphones supplied by the Education for Humanity team.

Purpose

Through this new, innovative technology and course delivery model, the Education for Humanity: Powered by SolarSPELL programme, intends to deliver high-quality, university-level education to refugee learners located in resource-constrained environments. Therefore, the purpose of this study was to assess the ability of the upgraded SolarSPELL technology to deliver the AGB250, agri-business course in the resource-constrained environment of Nakivale settlement, Uganda. This study included the extent to which the programme addressed the previously described challenges to delivering online higher education to resource-constrained communities: cost, connectivity, power source, and access to Internet-enabled devices. This article present the results and findings of this study.

Methods

Student enrolment consisted of 10 females and 20 males, from six countries: Burundi (5), Democratic Republic of the Congo (9), Rwanda (3), Somalia (1), South Sudan (4), and Uganda (8). The students were recruited by Windle International Uganda, which runs the Nakivale Vocational School at which the AGB250 course took place. In their recruitment efforts, Windle was instructed by the Education for Humanity team to strive for equity in gender representation and to recruit from both the refugee and local community. While success was more readily apparent in the latter effort than in the former, the cohort was still well-represented on both accounts. Course implementation was managed by two local facilitators, both of whom were recruited and hired by Windle International Uganda.

To obtain in-depth perspectives and informed opinions from both participant groups, the study utilized a mixed methods research design. The qualitative portion of the study focused on interviews with the local course facilitators. The researchers embraced an emergent design, allowing for unstructured dialogue with research participants (Lincoln and Guba 1985) and positioning them as knowledge producers. This approach also allowed the researchers the flexibility to revise and adapt the questions posed to participants to gain further specificity and understanding on topics of interest (Cresswell 2014). The researchers developed the interview protocol, which included probing questions if participants did not provide direct responses, and conducted the interviews prior to programme implementation and upon programme completion. The quantitative portion of the study consisted of questionnaires distributed to enrolled students at programme implementation and upon programme completion.

The interview protocol and questionnaires were reviewed by Windle staff to ensure that questions were culturally appropriate and ethically sound and would garner useful responses. Once Windle cleared the interview protocol and the questionnaires, the researchers obtained clearance for the study from Arizona State University's Institutional Review Board. For all interviews and questionnaires, data collection occurred in-person and all respondents signed a consent form. Interviews were audio-recorded, and transcriptions were produced. Each interview lasted an average of 15 minutes.

In addition to the facilitator interviews and student questionnaires, the researchers developed and implemented an accompanying set of data collection tools to create an information feedback loop during each programme phase. The comprehensive suite of the programme's data collection tools was broken into three programme phases.

Pre-Implementation Phase

Prior to course implementation, the researchers and SolarSPELL staff collaborated to implement a 3-day training workshop for the two course facilitators. In addition to the student pre-programme questionnaire and facilitator pre-programme interviews, staff implementing the training completed daily observation templates:

- Student pre-questionnaire (28 of 30 completed; 93 per cent);
- Facilitator pre-interviews (two completed); and
- ASU staff observations (six completed by two staff).

Monitoring of Programme Implementation Phase

During the 8 weeks of course implementation, the researchers led bi-weekly calls with the two facilitators and the course professor. The researchers also tasked the facilitators with completing bi-weekly reports based on a standard set of questions. The bi-weekly calls and bi-weekly reports were alternated so the researchers were in weekly communication with the course facilitators. Throughout implementation, the researchers reviewed course data as students completed course assignments and activities:

- Bi-weekly team calls (four completed);
- Bi-weekly facilitator reports (four completed); and
- Course Data (26 of 30 students completed the course).

Post-Implementation Phase

In addition to the student post-programme questionnaire and facilitator post-programme interviews, the researchers conducted a post-programme interview with the programme lead:

- Student post-questionnaire (24 of 30 completed; 80 per cent);
- Facilitator post-interviews (two completed); and
- Programme lead post-interview (one completed).

Results and Findings

This section will present the results and findings from the perspective of the programme participants on whether the offered solution was able to effectively and satisfactorily deliver a university-level course in a resource-constrained environment. These perspectives will be presented in four sub-sections: (1) the course; (2) the technology delivering the course; (3) the solution's ability to address the main barriers to delivering higher education to resource-constrained environments: cost, connectivity, power source, and access to Internet-enabled devices; and (4) the overall viability of the solution.

Within each sub-section, quantitative data from the student questionnaires will be presented along with themes discovered from the qualitative responses provided by the programme participants. Where appropriate, supporting and illustrative quotes from participants will also be presented. To provide a sense of representation from the students and facilitators, the codes assigned to the respondents are provided with each quote. The codes are as follows: students (S1–S30) and facilitators (F1–F2).

Participant Perspective of the Course

From the pre-programme questionnaire, 92 per cent of students indicated that they had never taken an online course ($n = 24$). In addition, 85 per cent of students had never taken a university-level course ($n = 26$). While this indicated that most students had no prior experience with which to compare the AGB250 course, it also meant that students were experiencing an online university course from a fresh perspective unburdened by past results.

When students were given an opportunity to assess the greatest strength of the AGB250 course after they had completed it, three main themes emerged. Nine students stated that the greatest strength of the course was that it could be accessed through technology, which consisted of the SolarSPELL's Wi-Fi hotspot and accompanying devices: 'The greatest strength of the agribusiness course is that it can train a learner to teach himself by using technology devices' (S2). Seven students shared that the course's strength was in increasing learners' business and economic knowledge: 'The greatest strength of the AGB250 agribusiness course is that it deals with how individuals can manage their resources either in agriculture or other businesses' (S1). Four students expressed that the course's greatest strength was in increasing learners' knowledge of agriculture: 'The greatest strength of the AGB250 course is that it equips a learner with the skills and knowledge about how agriculture can be carried out globally' (S14).

Based on personal observation, the programme lead noted several strengths of the course. On the course's structure, the programme lead noted,

> 'The user-friendly and systematic set-up of each unit in the course. Facilitators commented that once students understood the format, they found it easy to go through the course as each unit was set-up the same'.

On the course's content, the programme lead stated,

> 'The multiple ways information was introduced and explained really helped learners to understand the material. If a learner did not understand a topic the first time or in one format, they could rely on further explanations and examples via other activities'.

Alternatively, students provided their assessment of the greatest weakness of the AGB250 course. Three students shared that they found no weaknesses with the course. Five students found fault with the approach of providing 12 devices for 30 students and described the situation as a 'shortage of devices' (S9, S13). Four students experienced difficulty in the course because they found that some key concepts were not well explained. Similarly, four more students shared that the level of English used to describe some of the concepts was too difficult to understand. Finally, four students stated that the course was too theoretical in nature and would have preferred a course with more readily applicable content: 'The greatest weakness of the AGB250: Agribusiness course is that it deals with a theoretical approach rather than a practical one' (S7).

Also, reflecting on course weaknesses, the programme lead acknowledged that some structural improvements are necessary, including clarifying the directions provided to the students for completing assignments, simplifying the directions to facilitators for grading the assignments, and better organizing the course gradebook. The programme lead also shared that student learning can be further enhanced by increasing the course's current level of contextualization. This effort would need to be balanced with the team's commitment to using only open-source materials in the course to avoid any copyright issues. In addition, the initial effort to procure open-source and contextualized materials proved to be a time-consuming and difficult process: 'I do not believe this is sustainable and scalable going forward. Not unless there is more manpower to help with contextualization during the design'. On the self-paced nature of the course, the programme lead acknowledged that the approach became a challenge during the quizzes and examinations, as it allowed students to take as much time as they wanted to complete them. This provided opportunities for students to compare and share answers, thereby compromising the integrity of these checks of their knowledge.

Also, this approach enabled some students to progress faster than the professor was able to provide feedback, limiting its usefulness.

Students also provided feedback on the 95/5 model (95 per cent offline and 5 per cent online) utilized for course implementation. Approximately half of the respondents found the model to be 'effective' (48 per cent), with another 39 per cent of students indicating that the model was 'very effective'. For the students who reported the model to be less than 'effective', responses focused on the slow response from the professor on the assignments they submitted during the 5 per cent online portion of the course: 'The 95/5 model was not favouring us somewhat due to that we never got the response in time for our work' (S13). The facilitators also provided their assessment of the 95/5 model, with one facilitator stating, 'I think it was real structured. The professor is out there getting some feedback from students, and we are also getting some feedback from him. I think the way it was done was very right' (F1). The second facilitator's comments supported this statement, but also noted that the 5 per cent portion was difficult: 'It was just the 5 per cent was hard because of cellular network issues and connectivity. But the 95 per cent, it was very effective' (F2).

Participant Perspective of Course Technology

While there were numerous innovative aspects that were necessary to deliver a university-level course to students in a resource-constrained environment, the upgraded SolarSPELL technology and individual Internet-enabled devices were the main conduits between the students and the course content. Overall, students had a positive assessment of the effectiveness of the SolarSPELL technology to provide access to the course. A large majority of respondents indicated that SolarSPELL was at least 'effective' in this task (38 per cent 'very effective', 50 per cent 'effective'). For the students who rated the SolarSPELL as less than 'effective', one student wished the technology had been better explained and one student noted trouble when trying to log in, which was most likely a username/password issue. Other responses focused on the possibility that the SolarSPELL's Wi-Fi signal could drop (although a large majority of students noted that the signal never dropped) or that the SolarSPELL battery could expire (although this never happened during the course).

When asked to reflect on the strengths of the SolarSPELL technology in providing access to the AGB250 course, most students described the value of learning online, remarking that they appreciated and enjoyed the opportunity to experience 'the modern technology of SolarSPELL' (S13). Furthermore, students appreciated the fast, consistent, and strong network connection that SolarSPELL provided—a phenomenon not usually available in resource-constrained environments (Farmer and Boots 2013). One student (S16) shared, 'The greatest strength was the network speed, which allowed us to access the course very quickly'. Another student (S3) noted, 'The SolarSPELL technology was very good in accessing the course. There was never a disturbance in the connection'.

When asked to assess the greatest weakness of the SolarSPELL technology in providing access to the AGB250 course, four students remarked that the reliance on sunshine to charge the battery was a weakness. These students described the overcast days they experienced when the battery was not able to be fully charged using only the solar panel, forcing the facilitators to use the electrical outlets to complete the task. Two students noted that the batteries that powered the SolarSPELL should be upgraded so they could provide access over a longer period. Two students described the short 50-foot radius of the SolarSPELL's Wi-Fi signal, which caused some students' devices to drop their connection if they strayed too far from the source. As the students had previously expressed, both facilitators also shared that the number of devices (12) was too few for the number of students (30): 'The devices ... having to share them at the beginning. The students had the idea that they would have their own device to study on' (F2). The facilitators also corroborated that the weather and the battery capacity negatively affected their ability to charge the SolarSPELL. One facilitator stated, 'From the time we started, the weather wasn't that good to charge the devices'. (F2). The other facilitator, reflecting on the weather, added, 'The solar charging was an issue. We also needed to use the electricity to charge the batteries' (F1).

Students also provided their perspective on the user-friendliness of the SolarSPELL technology. A little over half of the students reported that the SolarSPELL was 'very user-friendly' (54 per cent), with another 29 per cent of respondents indicating that the technology was 'user-friendly'. For the students who rated the SolarSPELL as less than 'user-friendly', responses again focused on the limited number of devices provided to access the course content on the SolarSPELL. Their responses did not focus on the SolarSPELL technology itself.

As a final measure of their perspective on the SolarSPELL technology, students indicated their level of satisfaction with using the technology to access the course. Almost all students were at least 'satisfied' with the technology (65 per cent 'very satisfied', 30 per cent 'satisfied'), with only one student expressing that they were 'not at all satisfied'. This student attributed their dissatisfaction to not understanding all of the concepts presented in the course, which they felt limited the knowledge gained through the course.

Addressing Barriers to Online Higher Education in Resource-Constrained Environments

Given the previously discussed literature, any solution that intends to deliver higher education in a resource-constrained environment will need to address four main barriers: (1) cost; (2) connectivity; (3) power source; and (4) access to Internet-enabled devices. Throughout programme planning and implementation, the researchers collected information to assess the extent to which the solution addressed these barriers.

In terms of cost, an initial capital investment was made to purchase two SolarSPELL boxes, the accompanying 12 Internet-enabled devices, and two facilitator smartphones with data cards. Once purchased, the initial time commitment from ASU staff to build both the technology and the course represented the bulk of the financial outlays. From the time the technology team and course team were assembled in February 2018 to the completion of testing in March 2019, 12 ASU staff from four different departments contributed approximately 4500 hours to bring the solution from idea to reality. During implementation, the two course facilitators and ASU-based professor were compensated for the 8-week duration of the course. For the learners themselves, the course was entirely free as no course fee was requested. Student transportation to and from the school was an ongoing cost for 26 of the 30 learners as they continued to travel to and from their homes to attend their vocational courses at the school.

In terms of connectivity, the SolarSPELL emits a Wi-Fi signal up to a 50-foot radius for as long as the unit's battery has a charge. During the course, students arranged their desks in a circle around the SolarSPELL. Over the 8-week timeframe, the Wi-Fi connection did not drop once, thereby offering a strong, continuous connection to all learners. Only when a student errantly wandered out of the Wi-Fi radius did they lose connection. This consistency allowed the students to complete the course within the 8-week timeframe allocated for the course.

In terms of the power source, the facilitators were trained to rely entirely on the sun to charge the SolarSPELL's battery via its solar panel. However, the facilitators needed some time to settle into a charging routine. During the first week of the course, the facilitators attempted to rely solely on solar charging but found that variability in the weather negatively affected the ability of the battery to be charged. This led the facilitators to supplement the solar charging via electric outlet. The facilitators eventually settled on a combination of solar and electric charging, which took an average of 8 hours to complete. Over the 8-week timeframe, the SolarSPELL was utilized Monday through Friday for 7 hours per day and the unit's battery lasted an average of 16.5 hours per charge. There was a jump in battery longevity in the final week, which the facilitators attributed to fewer students drawing power from the SolarSPELL, as some students completed the course faster than the intended 8 weeks.

In terms of devices, the 30 learners were provided with 12 devices (6 laptops and 6 tablets). The facilitators were supplied with three foldable solar charging panels and four external batteries and trained to charge the 12 devices and batteries at the end of each class day. The course designers chose to provide 12 devices for 30 learners as they hoped that this approach would encourage the students to work and learn together. However, the learners took the initiative to coordinate within their cohort to schedule time when they would each be able to access a device on their own or with one other person. For the 5 per cent online portion of the course, the two facilitators were each provided with a smartphone and data card, which students used to complete their quizzes and tests. Scheduling these knowledge checks did not pose a challenge, as the self-paced nature of the course ensured that students' test schedules were adequately staggered.

Viability of the Solution

With Education for Humanity's interest in continuing to expand higher education opportunities for displaced communities, programme participants provided their perspectives on whether they viewed the upgraded SolarSPELL technology as an effective solution for bringing university-level education to areas without a network connection. For students, a large majority indicated that they viewed SolarSPELL as an effective solution (83 per cent 'yes'). Students who indicated that the SolarSPELL would not be an effective solution expressed that the technology would not be effective without a network connection. These explanations can be discounted as the SolarSPELL technology will always offer the ability to connect to its local Wi-Fi connection.

For facilitators, both agreed that it was a viable solution, with one facilitator sharing,

> 'I think it's very viable, because it makes it very easy to access all this content and the students don't have to worry about owning a smartphone or buying data. All you need to do is come for the knowledge. I think it' s very viable and very important' (F1).

To understand why they believed that the solution was a viable one, the facilitators were asked to describe the factors that contributed to its viability. Facilitators described the value of having a strong, consistent network connection and reliable power, which allowed the students to focus solely on the content they were studying. They also described the students' motivation and commitment to complete the course, which students shared was due to the course being university level and from an American institution. These two characteristics pushed the students to see if they could learn just as well as those from a 'first world university' (F1). Facilitators also described factors that could limit the solution's long-term viability, which included the limited number of devices to access the course, the need to upgrade the SolarSPELL battery, the reliance on solar energy when the weather is not cooperative, and how the quizzes and examinations should be timed to discourage cheating.

Neither facilitator stated that any major changes needed to be made to the course, the programme, or the overall process, but took the opportunity to advocate for more course choices being available to the students. One facilitator advocated for, 'More courses. More courses where they have the freedom to choose from. Whatever they want to study ... I think it would really be good' (F1).

Discussion

At the end of programme implementation, 26 of 30 students had completed and passed the 8-week course. For the four students who did not complete the course, three dropped out without completing any assignments, and one, a French speaker, dropped out due to difficulty understanding English. This amounts to an 87 per cent completion and pass rate for a traditionally marginalized population taking a university-level course delivered via new technology in a resource-constrained environment. Reflecting on all the barriers the programme was faced with, a facilitator summarized,

> 'I've been working with refugees since 2015. Most of them do not complete their studies. They easily drop out because there are so many challenges. But when you have an 87 per cent completion rate like this programme, that was really great . . . so, so great!'

Implicit in the facilitator's reference to challenges are the logistical barriers that limit a university's ability to provide higher education in resource-constrained environments. In this section, we will reflect on the study's findings to provide some perspective on the programme's ability to address and overcome the barriers of cost, connectivity, power source, and access to Internet-enabled devices.

Cost

The bulk of the solution's costs were driven by the initial need to upgrade existing SolarSPELL technology to host a university-level course and to adapt an existing course that optimized the technology being built. The technology team and course design team required ongoing communication and collaboration to discover the needs and limitations of each other's deliverable and to figure out how to make the resulting solution usable in a low-resource environment. As the solution was built in a university environment, the diverse set of experts necessary to bring the plan to reality was readily accessible: agribusiness experts collaborated on the course content; programming, developer, and hardware experts built an upgraded SolarSPELL capable of offering an online course experience via an LMS and software experts developed the code necessary to make all the technology components work together. When taken together, the entire process required approximately 4500 hours to complete—the equivalent of two staff working full-time for 1 year. However, this time included both building the new technology and the course; further iterations can focus resources on technology refinement and course development. Overall, while the solution proved to be a resource-hungry endeavour, none of these costs were passed on to the learners—the course was offered free of charge to all participating students.

Future iterations of the AGB250 course will no longer require many of these initial start-up design and development costs. However, this study did identify additional upgrades necessary to improve the solution's viability. These include: (1) upgrading the SolarSPELL's internal battery to hold more power; (2) upgrading the SolarSPELL's voltage converter to improve the efficiency of the solar energy conversion process; (3) adding a timekeeping mechanism to the raspberry pi computer for timing quizzes and tests; and (4) adding additional contextualization to the course to improve cultural relevance. While these upgrades will improve the course experience and the solution's viability, they will require additional funds. In addition, expanding the solution's course catalogue to widen the learner base will also require funding. The design teams will need to strike a balance between performance, cost, and desired scale to ensure the solution remains cost-efficient.

Connectivity

The course delivery method mimicked an online course experience by providing a local Wi-Fi hotspot connection, which students could connect to via the supplied Internet-enabled devices. This approach allowed learners to not only increase their knowledge base on agribusiness but also develop their digital literacy skills (a study area that will be addressed in a separate article). While the programme therefore addressed and overcame the connectivity barrier, it did so by intentionally confining students to the 50-foot Wi-Fi radius within class hours. The solution's technology therefore limited students' freedom of movement and access to information. While technology typically expands these freedoms, it was necessary for this programme to limit them to ensure that all students could access the course content via the provided Wi-Fi connection. The Moodle LMS does have an offline application, so any student that owns an Internet-enabled device is able to access the course content while online, download it, and then access it from anywhere. The extent to which this was done was outside the scope of this study but remains a potential research topic on how access to higher education can expand beyond the radius of the Wi-Fi hotspot. Overall, the constraints of operating in a resource-constrained environment drove the programme's approach and structure.

The constraints of operating in a resource-constrained environment also manifested in other ways. Results indicated that four students experienced difficulty in the course because they found some key concepts were not well explained. Similarly, four more students shared that the level of English used to describe some of the concepts was too difficult to understand. While these eight students were able to complete and pass the course, it demonstrated the difficult circumstances of offering higher education in a resource-constrained environment: resources available for students to consult to help them decipher a word, concept, or topic area are limited. They are essentially confined to what is offered in the course material. This reality does not erase the achievement of the upgraded SolarSPELL's ability to offer a stable and continuous connection in a resource-constrained environment, but it does uncover a challenge that universities need to be aware of when offering online learning opportunities in these environments.

Power Source

The variability of the weather and an 8-week course timeframe limited the solar energy independence of the SolarSPELL. Out of necessity, the facilitators settled on a combination of solar and electric charging to meet the 8-week deadline and overcome weather uncertainty. If the researchers had instructed the facilitators to only rely on solar energy, the course still would have been able to be completed, but not within the 8-week timeframe. Upgrades to the SolarSPELL's battery and voltage converter will improve solar charging efficiency and increase the length of battery life. These upgrades will require testing to ensure that an 8-week university-level course delivered by SolarSPELL is able to be exclusively powered by solar energy.

Access to Internet-Enabled Devices

Faced with a resource-constrained environment, the programme designers settled on a strategy to simply provide 12 Internet-enabled devices to the 30 students. The limited number of devices was a deliberate approach to encourage students to collaborate, discuss course content, and teach one another. It is possible that this collaboration could have occurred if there was a device for every student but this is a possibility that will both increase the programme's cost and require additional study. The results of this particular study found that the limited number of devices was frequently noted as a challenge by both students and facilitators. The shortage affected students' schedules, as some chose to coordinate their attendance schedules in an effort to have access to their own device. This coordination was driven by students' desire to strengthen their digital literacy skills.

To act on these findings, the programme team faces three possible paths: (1) increase programme costs by providing Internet-enabled devices that equal the number of students in the course; (2) maintain the current number of devices but train facilitators to coordinate student schedules so each student has access to their own device; and (3) initiate a study on whether the collaboration that occurs from multiple students working together on a single device is more beneficial than each student working on their own device and allow the study results to drive programmatic decision-making.

Conclusion

The purpose of this study was to assess the ability of the upgraded SolarSPELL technology to deliver the AGB250, agribusiness course in the resource-constrained environment of Nakivale settlement, Uganda. This study also assessed the extent to which the solution addressed the current barriers to delivering online higher education to resource-constrained communities: cost, connectivity, power source, and access to Internet-enabled devices.

This study represents the first implementation of the upgraded SolarSPELL technology delivering a university-level course in a resource-constrained environment. The programme was small in scope, focusing on a cohort of 30 learners in a refugee settlement in southern Uganda. Therefore, the findings from this study should not be generalized to future implementations nor should they be seen as authorization to immediately expand and scale the solution. ASU will continue to refine the technology and course development process, and additional research will need to be completed on how these changes affect the solution's scalability, as well as programme and per-learner costs. However, this study found that SolarSPELL technology, equipped with an LMS, is a viable solution for delivering higher education in a resource-constrained environment, as the solution addressed the logistical barriers of cost, connectivity, power source, and access to Internet-enabled devices. This finding is relevant to all humanitarian organizations currently partnering with, or interested in partnering with, universities to provide higher education to communities affected by displacement. It is particularly relevant to the stakeholders committed to achieving UNHCR's pledge to increase refugee participation in higher education from 1 per cent to 15 per cent by 2030. This tempered and generalized conclusion is what Cronbach (1975) refers to as a 'working hypothesis'. The hope is that additional studies, particularly if the recommended upgrades to the course and technology are completed, will build confidence in this programme solution's practices, concepts, and approach, thereby continuing to produce findings related to the same theoretical proposition.

Acknowledgements

Our sincere appreciation is extended to Dr Laura Hosman, Bruce Baike, Chloe Scott, Kristen Linzy, Sara Jordan, and the entire SolarSPELL team for granting Education for Humanity access to the original SolarSPELL technology. The interest, support, library content curation, continued input throughout the project, and training provided by the SolarSPELL team were critical to this endeavour. Recognition also goes to Dr Marc Manfredo for the support provided by the W.P. Carey Morrison School of Agribusiness and Dr Jeff Englin, Octavio Valdez Lafarga, and Jeanette Mueller-Alexander for their efforts in finding and creating open-source content for the course. Acknowledgements are further extended to Deirdre Kirmis, Roger Kohler, and Chandi Cumaranatunge. We would also like to recognize the efforts put forth by our international partners, including the government of Uganda, UNHCR, Windle International Uganda, and Nakivale Vocational Training Center.

REFERENCES

ALLY, M. and **TSINAKOS, A.** (2014) *Increasing Access through Mobile Learning*. Vancouver: Commonwealth of Learning and Athabasca University.

ANSELME, M. L. and **HANDS, C.** (2012) 'Access to Secondary and Tertiary Education for All Refugees: Steps and Challenges to Overcome'. *Refuge* 27(2): 89–96.

BURNS, M. (2011) *Distance Education for Teacher Training: Modes, Models, and Methods*, http://idd.edc.org/sites/idd.edc.org/files/Distance%20Education%20for%20Teacher%20Training%20by%20Mary%20Burns%20EDC.pdf (accessed September 2019).

CHAFFIN, J. (2010) *Framing Paper 1: Education and Opportunity: Post-Primary and Income Growth*. New York: INEE.

CONNECTED LEARNING IN CRISIS CONSORTIUM (CLCC) (2017) *Quality Guidelines Playbook: Lessons Learned through Contextualized Practice*, https://connectedlearning4refugees.org/wp-content/uploads/2019/12/CLC_playbook_screen.pdf (accessed March 2020).

CREA, T. M. (2016) 'Refugee Higher Education: Contextual Challenges and Implications for Program Design, Delivery, and Accompaniment'. *International Journal of Educational Development* 46: 12–22.

CREA, T. M. and **MCFARLAND, M.** (2015) 'Higher Education for Refugees: Lessons from a 4-Year Pilot Project'. *International Review of Education* 61(2): 235–245.

CREA, T. M. and **SPARNON, N.** (2017) 'Democratizing Education at the Margins: Faculty and Practitioner Perspectives on Delivering Online Tertiary Education for Refugees'. *International Journal of Educational Technology in Higher Education* 14(1): 1–19.

CRESSWELL, J. W. (2014) *Research Design*, 4th edn. Thousand Oaks: Sage Publications.

CRONBACH, L. J. (1975) 'Beyond the Two Disciplines of Scientific Psychology'. *American Psychologist* 30(2): 116–127.

DAAD, (2019) *The Other 1 Percent—Refugees at Institutions for Higher Education Worldwide*, https://www2.daad.de/microsites/other-one-percent/en/ (accessed March 2020).

DAHYA, N. (2016) *Education in Conflict and Crisis: How Can Technology Make a Difference? A Landscape Review*. Germany: Deutsche Gesellschaft für.

DAHYA, N. and **DRYDEN-PETERSON, S.** (2017) 'Tracing Pathways to Higher Education for Refugees: The Role of Virtual Support Networks and Mobile Phones for Women in Refugee Camps'. *Comparative Education* 53(2): 284–218.

DANKOVA, P. and **GINER, C.** (2011) 'Technology in Aid of Learning for Isolated Refugees'. *Forced Migration Review* (38): 11.

DONALD, H. A. (2014) *Preparing for Uncertainty: Exploring Access to Higher Education in Dzaleka Refugee Camp, Malawi*. Toronto: York University.

DRYDEN-PETERSON, S. (2012) 'The Politics of Higher Education for Refugees in a Global Movement for Primary Education'. *Refuge* 27(2): 10–18.

DRYDEN-PETERSON, S. and **GILES, W.** (2010) 'Introduction: Higher Education for Refugees'. *Refuge* 27(2): 3–10.

FARMER, L. and **BOOTS, M.** (2013) 'Barriers and Solutions in Using M4D: Connecting Directly to Citizens for Scalable Impact', *VOTO Mobile Whitepaper*, http://www.data4sdgs.org/resources/barriers-and-solutions-using-mobile-development-connecting-directly-citizens-scalable (accessed October 2019).

GLADWELL, C., **HOLLOW, D.**, **ROBINSON, A.**, **NORMAN, B.**, **BOWERMAN, E.**, **MITCHELL, J**, et al. (2016) *Higher Education for Refugees in Low-Resource Environments: Landscape Review*. UK: Jigsaw Consult.

ICEF Monitor (2018) *Study Projects Dramatic Growth for Global Higher Education through 2040*, https://monitor.icef.com/2018/10/study-projects-dramatic-growth-global-higher-education-2040/ (accessed March 2020).

IGAD (2017) *Djibouti Declaration on Regional Conference on Refugee Education in IGAD Member States*, https://www.igad.int/divisions/health-and-social-development/1725-igad-ministers-of-education-endorse-djibouti-declaration-on-refugee-education (accessed March 2020).

KEKWALETSWE, R. M. (2007) 'Social Presence Awareness for Knowledge Transformation in a Mobile Learning Environment'. *International Journal of Education and Development Using Information and Communication Technology* 3(4): 102–109.

KIRUI, K. and **OSMAN, A.** (2016) 'Role of Borderless Higher Education for Refugees Programme in Offering High Quality Teacher Education and Training for Refugees in Dadaab Settlement in Kenya'. *Advances in Social Sciences Research Journal* 3(2): 9–19.

LATCHEM, C. and **JUNG, I.** (2010) *Distance and Blended Learning in Asia*. New York: Routledge.

LINCOLN, Y. S. and **GUBA, E. G.** (1985) *Naturalistic Inquiry*. Beverly Hills, CA: Sage Publications.

MACLAREN, D. (2010) 'Tertiary Education for Refugees: A Case Study from the Thai-Burma Border'. *Refuge* 27(2): 103–110.

MEANS, B., **TOYAMA, Y.**, **MURPHY, R.**, **BAKIA, M.** and **JONES, K.** (2009) *Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies*. Washington, DC: United States Department of Education.

NAYLOR, R., **TERRY, L.**, **RIZZO, A.**, **NGUYEN, N.** and **MIFSUD, N.** (2019) 'Structural Inequality in Refugee Participation in Higher Education'. *Journal of Refugee Studies* 32(3): 1–17

O'SULLIVAN, E. (2002) 'The Project and Vision of Transformative Education'. In O'Sullivan E., Morrell A. and O'Connor M.A. (eds) *Expanding the Boundaries of Transformative Learning (1-12)*. New York: Springer.

PERLMAN-ROBINSON, J. (2011) *A Global Compact on Learning: Taking Action on Education in Developing Countries*. Washington, DC: Brookings Institution.

PHERALI, T. and **MOGHLI, M. A.** (2019) 'Higher Education in the Context of Mass Displacement: Towards Sustainable Solutions for Refugees'. *Journal of Refugee Studies* 32(3): 1–21.

PURKEY, M. (2010) 'Paths to a Future for Youth in Protracted Refugee Situations: A View from the Thai-Burmese Border'. *Refuge* 27(2): 97–102.

REINHARDT, F., **ZLATKIN-TROITSCHANSKAIA, O.**, **DERIBO, T.**, **HAPP, R.** and **NELL-MULLER, S.** (2018) 'Integrating Refugees into Higher Education—The Impact of a New Online Education Program for Policies and Practices'. *Policy Reviews in Higher Education* 2(2): 198–226.

REINHARDT, S. (2018) 'Exploring the Emerging Field of Online Tertiary Education for Refugees in Protracted Situations'. *Open Praxis* 10(3): 211–220.

SAVE THE CHILDREN (2017) *Promising Practices in Refugee Education. United Nations High Commissioner for Refugees and Pearson*, https://www.promisingpractices.online/synthesis-report (accessed September 2019).

UNESCO (2017) *2017/18 Global Education Monitoring Report. Accountability in Education: Meeting Our Commitments*. Paris: UNESCO Publishing.

UNHCR (2016a) *Global Trends: Forced Displacement in 2015*, http://www.refworld.org/docid/57678f3d4.html (accessed September 2019).

UNHCR (2016b) *Connecting Refugees: How Internet and Mobile Connectivity Can Improve Refugee Well-Being and Transform Humanitarian Action*. Geneva: UNHCR.

UNHCR (2018) *Tertiary Education*, http://www.unhcr.org/en-us/tertiary-education.html (accessed September 2019).

UNHCR (2019a) *The Other 1%: Refugees at Institutions of Higher Education Worldwide, Conference Report*. Berlin: Federal Foreign Office, DAAD, and UNHCR, https://www.daad.de/medien/microsites/the-other-one-percent/report_2019.pdf (accessed October 2019).

UNHCR (2019b) *UNHCR Urges more Support to Boost Refugee Access to Tertiary Education*, https://www.unhcr.org/en-us/news/press/2019/10/5d95ed844/unhcr-urges-support-boost-refugee-access-tertiary-education.html (accessed March 2020).

WOMEN'S REFUGEE COMMISSION (2009) *Living in Limbo: Iraqi Young Women and Men in Jordan*, https://www.womensrefugeecommission.org/images/stories/Jordan_youth_FINAL_01_2010.pdf (accessed September 2019).

WORLD UNIVERSITY SERVICE OF CANADA (WUSC) (2018) *State of Play Digital and Blended Innovations for Increased Access to Post-Secondary Education for Refugee Youth*, https://s3.amazonaws.com/assets.wusc.ca/NEW%20website/02%20Impact/Reports%20and%20Publications/WUSC-State-of-Play-08.pdf (accessed March 2020).

ZEUS, B. (2011) 'Exploring Barriers to Higher Education in Protracted Refugee Situations: The Case of Burmese Refugees in Thailand'. *Journal of Refugee Studies* 24(2): 256–276.