

Refugee Higher Education and Future Reconstruction Efforts: Exploring the Connection through the Innovative Technological Implementation of a University Course in Nakivale Refugee Settlement, Uganda

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Higher education (HE) for refugees and displaced persons has often been considered a luxury. However, the humanitarian and educational sectors have recently committed to offering HE to this population. This is a welcome development, as research demonstrates that HE is intrinsically connected to development at the individual, community, and national levels. This study presents the findings of an HE program with thirty refugee students in Uganda which utilized offline technology to improve content knowledge in agribusiness, digital literacy, and other skills. The study's results advance the idea that refugees, upon return to their home country, are better able to contribute to the reconstruction efforts of post-conflict societies when they have participated in HE programs.

Introduction

Future reconstruction efforts in post-conflict areas, where warfare has ended but reconstruction and peace are still in the formative process, are dependent on current efforts in higher education (Cloete, 2011). Higher education (HE), defined here as all post-secondary educational program opportunities, is necessary for successful and sustainable reconstruction processes implemented through inclusive, sustainable, gender-equitable, and peaceful means (WUSC, 2018; Cloete, 2011). Despite this, HE for refugees and displaced persons has often been thought of as a luxury and not a priority (Dryden-Peterson, 2012). This is evident through the 70.8 million displaced people and refugees around the world for whom educational opportunities are extremely limited and access rates scant in comparison to global averages (UNHCR, 2019a). Approximately half of all refugee children have access to primary school, only 22% have access to secondary school, and only 3% have access to HE in comparison to 36% of global youth (Save the Children, 2017; UNHCR, 2019a; UNESCO, 2017).

While access to HE education still lags far behind where it needs to be for these marginalized populations, global humanitarian efforts and support for HE education have recently increased. In the early 2000s, the Dakar Framework for Action (2000) and Africa Regional Training Conference on Tertiary Education (2003) brought the issue of HE for displaced populations to the forefront. In 2015, the United Nations adopted Sustainable Development Goal 4, which aims to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” by 2030 (UNHCR, 2019c). In 2018, the Comprehensive Refugee Response Framework and the Global Compact on Refugees highlighted HE education as a solution for refugee inclusion and integration, thereby allowing them to “thrive, not just survive” (Grandi, 2019). Most recently, attendees at the December 2019 Global Refugee Forum targeted education and its financing as a main goal for humanitarian efforts moving forward, setting a goal of increasing refugee participation in HE from 3% to 15% by 2030 (#15by30).

However, despite growing support and efforts, existing HE programs do not always address the current barriers refugees face in accessing HE, such as their isolated location in low-resource environments, and a lack of technological and built infrastructure, electricity, access to devices, and internet connectivity, among others (Bauer & Gallagher, 2020). Additionally, existing HE programs do not tailor their content and structure to provide the knowledge and nurture the skills refugees will need to contribute to reconstruction efforts when they return to their countries of origin, such as “self-management; thinking and solving problems; working together and communicating, ...understanding the business..., effectively using numbers, IT, and language” (Thayaparan et al., 2015, p. 341).

In this context, Arizona State University’s (ASU) Education for Humanity program (E4H) piloted a four-month program from April to July 2019 that provided a university-level course to 30 learners (see Methods for additional learner data) in a resource-constrained environment via solar-powered, offline/online technology that allows access by any Wi-Fi enabled device via a Wi-Fi hotspot. This article presents an overview of the existing literature and explores the role that the results of this program has in informing the field of refugee higher education, the use of technological solutions to meet international goals, and the connection between university-level topical knowledge, digital literacy, and other gained skills with future reconstruction efforts in post-conflict societies.

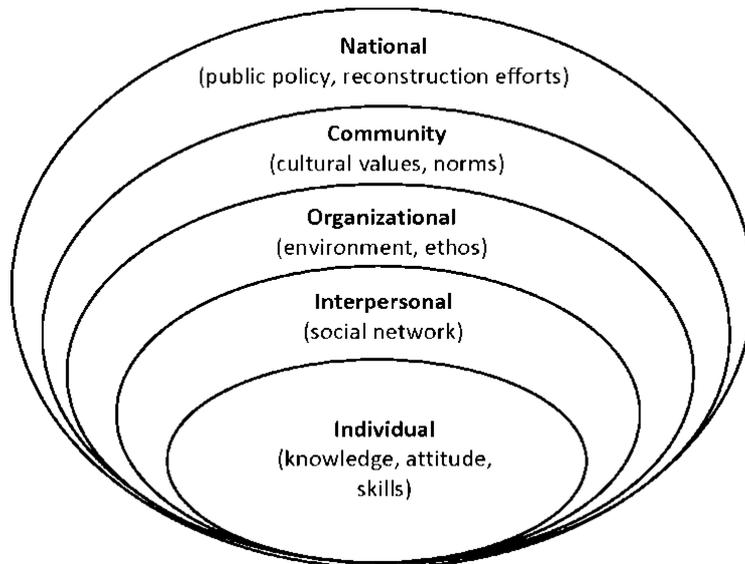
Literature Review

A refugee, as defined by the 1951 Refugee Convention which codified their rights at the international level, is “someone who is unable or unwilling to return to their country of origin owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group, or political opinion” (UN General Assembly, 1951, p.3). Currently, refugees face an average displacement time of 26 years

(UNHCR, 2016). In 2018, 2.9 million displaced people, including 600,000 refugees, returned to their home communities (UNHCR, 2019b).

The Socio-ecological Framework Model

Refugees live in a context where their behaviors influence and are influenced by their unique social environment. This study draws upon the social-ecological framework of



Berkes and Folke (1998) and the socio-ecological frameworks of Bronfenbrenner (1977, 1979) and Henderson and Baffour (2015). The frameworks are utilized to provide structure for this paper's position that refugees that have participated in HE can have a more beneficial impact on post-reconstruction societies once they return to their home countries due to the mutual and collective influence of individuals and communities on each other. The framework embraces the idea that individual gains and those of the larger system(s) are all connected and interdependent. The figure below (Figure 1), adapted from Bronfenbrenner's (1979) model, visualizes how these various levels interact and influence each other, and, for the purpose of this study, represents how individual access to HE has important ripple effects when applied at the community and national levels.

Figure 1. *Socio-Ecological Framework Model*. Adapted from "Toward an experimental ecology of human development," by U. Bronfenbrenner, 1977, *American Psychologist*, 32(7), 513-531.

This framework emphasizes that the decisions, actions, and behaviors of individuals are impacted by their existence in specific physical environments and contexts that have mutual exchanges (Colding & Barthel, 2019). However, as researchers, we also recognize that refugees are not homogenous or monolithic. Their intersectional lives,

the overlapping oppressions and identities, defined both individually and via social relationships and structural levels, are impacted by their lived situations (Crenshaw, 1991; Collins, 2000). As such, refugees' multiple-situated identities at both the individual level (i.e. how they define themselves via ethnicity, gender, etc.) as well as the way external systems define them (i.e. refugee policies of host-country and global governing bodies; citizenship status; economic access, etc.) affect them and their access to HE.

Using the socio-ecological framework to structure the literature, the next few paragraphs will explore the benefits of HE, how they affect refugees at the individual level, and explore the ripple effect that occurs when each benefit accumulates and then radiates outwards to the interpersonal, organizational, community and national levels. Finally, we will present how this accumulation influences reconstruction efforts in post-conflict societies. This structure will demonstrate how the interdependent relationships between educated refugees and their larger communities influence one another and have the potential to benefit post-reconstruction societies.

Higher Education and Prosperous Societies

Higher education has long been hailed as a fundamental component of stable and prosperous societies (Ferede, 2018), and its presence in society has been shown to improve feelings of hope and increase the spectrum of available opportunities for individuals affected by displacement (Crea, 2016). Wright and Plasterer (2012) showed that participation in HE creates resilient, supportive, and thriving communities, and provides the foundation needed for the creation of stable, functioning societies. Bloom et al. (2014) notes that investments made in HE help to accelerate technological diffusion, decrease knowledge gaps, reduce poverty, and result in greater economic returns for society.

Reflecting on the various roles of HE, Van Laar et al. (2017) and Pheeraphan (2013) both note that the role of HE is not to simply train students for a specific job with content knowledge and technical/hard skills, but to cultivate and nurture the skills needed to adapt to evolving job responsibilities, process information, and become lifelong learners. Brown (2018) noted the wide spectrum of skills that HE cultivates, including soft skills like written and oral communication; critical thinking; leadership; confidence; teamwork; and work ethic, and technical/hard skills which directly relate to the type of subject being studied, such as building knowledge for construction or mathematical knowledge for accounting.

In addition to topical content knowledge and soft skills, HE also develops core competencies in digital literacy, including skills to understand and use technology in a society where access to information is predominantly through digital platforms, which

are not often available in secondary education (Kay, 2010; Trilling & Fadel, 2009). Technology divides often exist in marginalized societies, which then carry over to post-conflict societies (Pheeraphan, 2013). In some refugee camps and settlements, digital literacy programs are recognized as an area of need and offered to learners, but this is not yet the norm (GIZ, 2016). Recognizing the important role digital literacy skills will play in building knowledge-based economies, Van Larr et al. (2017, p.577-578) expressed that "the development of the global knowledge society and the rapid integration of ICT make it imperative to acquire digital skills necessary for employment and participation in society." Refugees recognize the benefits of gaining digital literacy skills by demanding access to technology as part of any HE opportunities offered to them (Dryden-Peterson, 2012). Crea (2016) learned from refugee students enrolled in HE that access to technology helped increase their technical and professional skills. In cases where students had not been exposed to technology, these skills were not developed, and negatively affected their professional opportunities.

Higher Education and the Role of the Individual in Community and National Reconstruction Efforts

On an individual level, the literature concludes that HE strengthens psycho-social functions (Ferede, 2018), builds positive self-identity necessary for leaders to mitigate feelings of fear and persecution (Zeus, 2011), promotes a sense of pride, accomplishment, and personal growth, and improves leadership, communication, and language skills (Crea, 2016). Furthermore, participation in HE allow refugees to gain the necessary knowledge and skills to contribute to their development and growth at the personal level - a critical need as knowledge-based economies increasingly become the global norm, (Van Laar et al., 2017; Pheeraphan, 2013; Dryden-Peterson & Giles, 2010).

Moving outward from the individual level on our socio-ecological model, once a critical mass of individuals possess these types of skills and knowledge, it influences society's ideology, cultural norms, and public policies (Henderson & Baffour, 2015; Clark, 2006). On an interpersonal level, HE cultivates soft skills such as inclusivity, tolerance, collaboration and teamwork, and critical thinking and problem-solving skills (Brown, 2018), that can contribute to the development of social networks, the establishment of cultural norms and beliefs, and influence public policy (Van Larr et al., 2017; Thayaparan et al., 2015; Henderson & Baffour, 2015; Pheeraphan, 2013; Tahiraj, 2010). These skills manifest in the development and implementation of inclusive policies and programs in post-conflict societies (WUSC, 2018; Tahiraj, 2010), thereby linking the individual skills gained from HE to the community and national levels of the socio-ecological model. The ability to listen to and understand other's views gained from the collaborative work stressed in HE manifests at the community and national levels through policies and programs that aim to meet the needs of the many (Brown, 2018).

In the context of post-conflict reconstruction efforts and activities, the skills and knowledge gained from HE will be expressed at all levels of our socio-ecological model. Higher education “equip[s] students to contribute to socio-political and economic reconstruction” (WUSC, 2018 p. 6). University-level courses provide refugees with the topical, readily applicable knowledge and skills necessary for reconstruction efforts (Thayaparan et al., 2015; Trnavcevic, 2010) that are needed at the individual, community, government, and cultural levels for a well-functioning society (Henderson & Baffour, 2015). In looking at the contributions of resettled university graduates, WUSC (2018, p.5) notes that “many resettled students make the decision, later in life, to return to their countries of origin to contribute their skills and knowledge to rebuilding efforts, helping to ensure a more inclusive, sustainable, and peaceful process.”

Making a more practical connection between HE and the skills needed for reconstruction, Collier (2000) argues that one of the risk factors in post-conflict societies is ethnic dominance. Higher education often promotes integration and intercultural competence by providing opportunities for learners to collaborate with people from diverse backgrounds and create more stable and diverse interpersonal social networks (Law et al., 2019). This applies to the gender equity of reconstruction efforts and policy as well: an individual’s gender and intersectional identity influence how they view and perceive conflict and reconstruction and will influence public policy in communities at local and national levels (Kaufman, Williams & Ebc., 2016 Henderson & Baffour, 2015).

Reflecting on the long-term durability and sustainability of these post-conflict reconstruction efforts, Wright and Plasterer (2012, p.104) concluded that the knowledge and skills refugees obtain through HE result in more effective and durable solutions and are “a strategic [issue for] long-term processes of post-conflict recovery and peacebuilding.” Post-war South Korea provides an example of when national policy makes a direct connection between HE and durable development and reconstruction. South Korea prioritized the development of formal education institutions (primary, secondary, and tertiary) and self-described the effort as ‘education fever.’ The country now cites this effort as a reason for its ability to grow and succeed post-conflict (Seth, 2010). Indeed, currently ranked 36th globally, they have been highlighted as one of the most developed and strongest HE systems in the world (Mani, 2018).

Looking once again at our socio-ecological model, post-reconstruction societies do not develop in a vacuum. Individuals apply their gained knowledge and skills, build and participate in democratic processes, create social networks, and together affect the economic prospects of their immediate communities, which, in turn, collectively

determine the relative success of post-conflict reconstruction efforts. Therefore, efforts to provide individual refugees with HE access, along with the topical content knowledge, soft skills, and digital literacy skills that accompany it, will collectively and positively impact the success and sustainability of reconstruction efforts in post-conflict societies (Bloom et al., 2014). Future reconstruction efforts are therefore dependent upon current efforts in HE. When refugees return home, reconstruction efforts will be reliant upon citizens with knowledge and skills gained from HE to lead and implement reconstruction efforts. The literature has demonstrated that a more durable and sustainable post-conflict society is created when populated by citizens with the ability to think critically and solve problems in the face of the inevitable challenges faced during reconstruction efforts. Summarizing the benefits of HE in the area of national reconstruction efforts, Trnavcevic (2010, p.99) states that "the re-establishment of education contributes to normalization, democratization, and economic recovery."

Purpose Statement

The purpose of this study was to assess growth in agribusiness and digital literacy knowledge and skills of refugee learners of Nakivale settlement, Uganda who participated in the AGB250: Agribusiness course. This paper will demonstrate how this program advances the idea that refugees, upon returning to their home country, can better contribute to the reconstruction of post-conflict societies when exposed to higher education content delivered via innovative methods that aim to build digital literacy skills.

Methods

Despite the demand for HE, the various benefits it provides, its ability to foster strong and resilient post-conflict communities, refugees still face many access barriers, such as cost, infrastructure, connectivity, access to devices, lack of documentation and many others (Bauer & Gallagher, 2020). An innovative technological solution was one way to simultaneously diminish these barriers, create opportunities for access to HE, and offer the opportunity to acquire digital literacy skills.

The open-source course was housed in the learning management system Moodle, on a raspberry pi computer¹ in a SolarSPELL, which is a portable, solar-powered, digital library for use in low-resource 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. The SolarSPELL

¹ The combination of the Moodle LMS with a Raspberry Pi computer is called a Moodlebox, an idea originally generated by Nicolas Martignoni. For additional information, see: <https://moodlebox.net>

therefore mimics an online experience to help build learners' information literacy, technology, and digital learning skills in a safe, offline learning environment (Bauer & Gallagher, 2020). Given previous research on technology's ability to open education pathways to refugees (Dahya, 2016; Mendenhall et al., 2018), this program used technology to create educational access for a marginalized community and paired it with human support. In order for learners, facilitators, and the faculty member to stay connected, the ASU team used a 95/5 model. The 30 learners could access the 95% offline material via 12 internet-enabled devices (6 laptops and 6 tablets) and the other 5% was accessed online via mobile connectivity from smartphones. All devices were provided by ASU.

The initiative took one year to design and build. Implementation occurred from April to July 2019 by ASU's E4H program, in partnership with Windle International Uganda (WIU). The site and agribusiness course topic were chosen based on E4H's internal research and needs assessment conducted via interviews in camps, settlements, and urban centers in the Middle East and East Africa with refugee-service providing organizations. Nakivale, Uganda was chosen based on numerous factors discovered through this process, including: 1) strong learner interest due to WIU's existing agriculture vocational program, 2) the community's robust agrarian economy, and 3) Uganda's liberal laws and policies in regards to refugees, such as their employment rights, freedom of movement, and access to social services including health and education, mandated through its membership in the Intergovernmental Authority on Development (IGAD), and as a co-signatory of the Djibouti Declaration on Refugee Education (World Bank, 2016).

Student enrollment 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). Students were recruited through Windle's Vocational Center in Nakivale, Uganda, of which all 30 students were active in the agricultural vocational program. Facilitators consisted of one female and one male, who were English speakers, with IT backgrounds. The students, in addition to the two local facilitators who managed and implemented the course, were recruited by WIU through flyers and WhatsApp messages. Guidelines for target learner recruitment included: age of 18+, strong English skills (as the course is in English), were ready for courses at the university level, expressed interest in the course topic, were a mix of refugees (non-Ugandan learners) and host community members (Ugandan), and gender parity. Facilitators were hired based on their English and digital literacy skills and to achieve gender parity. Windle was instructed by the E4H team to strive for equity in gender representation and to recruit from the refugee and local communities. While success was more readily apparent in community diversity, Windle struggled to achieve gender equity as they were limited by the applicant pool. Course oversight, grading, and feedback on student

assignments was overseen and implemented by the ASU course professor via the course gradebook and WhatsApp. The program culminated in a certificate ceremony for those who passed the course.

The study utilized a mixed methods research design. Qualitative components included facilitator interviews and student questionnaires prior to and after program implementation, and embraced an emergent design, allowing for unstructured dialogue with research participants and the use of probing questions (Lincoln & Guba, 1985). This positioned the facilitators as knowledge producers and allowed for flexibility to revise and adapt the questions (Cresswell, 2014). The interviews were conducted, and the questionnaires were distributed by Education for Humanity's Research and Evaluation Specialist (a white man) and Project Manager (a white woman) who are both from the United States. In collecting information from marginalized people in a developing country, both staff recognized the inequities in power that their backgrounds presented (Beneria, 1999; Mies, 1991; Suet-Tang, 2008). To mitigate the effects of these dynamics, Windle staff reviewed all protocol and questionnaires for cultural appropriateness, ethical standards, and to ensure useful responses. ASU's Institutional Review Board provided internal clearance. Interview and questionnaire data collection occurred in-person with signed consent forms. Interviews were audio-recorded and lasted approximately 15 minutes, and transcriptions were created afterwards.

To generate an information feedback loop throughout the program, a supplementary set of data collection tools was developed. The comprehensive evaluation process was separated into three program phases: 1) pre-implementation assessment, which consisted of the pre-program student questionnaire and facilitator interviews; 2) program monitoring, which consisted of bi-weekly calls with the researchers, facilitators, and course professor, bi-weekly reports completed by the facilitators via WhatsApp, and course activity monitoring; and 3) post-implementation assessment, which consisted of the post-program student questionnaire and facilitator interviews.

Analysis of qualitative responses was completed using Dedoose. Qualitative analysis was purely inductive; codes and themes were generated from the collected data and not from the socio-ecological framework or other theory. Quantitative analysis was conducted on the student pre- and post-questionnaires in the form of paired t-tests via SPSS.

Results and Findings

This section presents results and findings regarding learner development in digital literacy and agribusiness comprehension and skills. They will be presented in three sub-

sections: 1) program participant expectations; 2) agribusiness program outcomes; and 3) digital literacy program outcomes.

Quantitative data will be presented along with themes discovered in the qualitative responses from the learners, facilitators, and professor. When applicable, illustrative participant quotes are presented as supporting evidence to each theme area, and coded as follows: students (S1 to S30), and facilitators (F1 to F2).

Program Expectations

The pre-program questionnaire found that 92% of students had never taken an online course (n=24), and 85% had never taken a university-level course (n=26). This indicated that the majority of students had no prior comparable experience to relate to the current AGB250 course and that learners would be taking the course without influence from previous university course experience.

To gain feedback on program expectations, students were asked to complete the following sentence: "At the end of the AGB250 Agribusiness course, I expect to...". Of the 28 responses, six main themes were found. Twelve students hoped that the course would improve their digital literacy skills, including their comfort and confidence levels in using computers, tablets, and smartphones. Similarly, the course facilitators stressed the importance of exposing students to the different technologies utilized in the course. They believed the students would be highly motivated to participate based on the opportunity to use these devices, thereby capitalizing on this rare opportunity to strengthen their digital literacy skills. Facilitators cautioned that while they expected students to be excited about using new technologies, they also expected them to struggle in the early days due to low digital literacy. Facilitators expected that this would require time to orient students to the various course devices. Nine students focused their responses on agribusiness: five learners hoped to improve their skills in agribusiness and four hoped to improve their knowledge of agribusiness. Facilitator responses supported this, indicating that the course could improve students' business knowledge of agriculture: "In Uganda, agriculture is seen as one of the main economic ways of living. I think it would be very good for [students] to know that when they grow a certain kind of crop, it will have a certain price at the market... economically, the course will be beneficial for them" (F2). Nine students also reported that they hoped to apply what they learned from the course, including sharing information with fellow community members, securing a job in the agribusiness field, or starting their own agriculture-based business: "I hope that the agribusiness course will help me for the rest of my life, not only as the source of an employment opportunity, but also during my daily life" (S2). Three students expressed hope that this course would help them academically: "I will gain more skills and experience in agribusiness, and I also hope to continue with this course up to the Master's level" (S15). Three students expected to

work together with course facilitators and fellow classmates to collaboratively improve their knowledge and skills in both agribusiness and digital literacy: "My expectation is to work together with my fellow learners to develop our skills for the future" (S11). Finally, three respondents looked forward to receiving a certificate upon successful completion of the course.

Program Outcomes - Agribusiness Skills

At the end of the eight-week course, 26 of 30 students completed and passed (Table 1), as based on grading standards that included polls and other interactive activities, reflection boards, unit quizzes, and a final exam. For those that did not, three dropped out without completing any course content, and one dropped out due to difficulty understanding English. Final course grades were as follows:

Table 1. Course Grades (n=30)

A+	17%
A	57%
A-	7%
B	7%
Incomplete	13%

The completion and pass rate was 87% for this often marginalized population attempting a university-level course delivered via new technology in a low-resource environment. Reflecting on the program barriers, 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% completion rate like this program, that was really great...so, so great!" (F2). Similarly, the course professor remarked, "This was the best class I have ever had. I would put these students right up there with my best ASU students."

In terms of learning outcomes, students self-expressed that the course increased their knowledge of agriculture: "The greatest strength of the AGB250 course is that it equips a learner with the skills and knowledge about how agriculture is carried out globally" (S14). Additionally, both facilitators shared that the students increased their knowledge of business and economics, which are of increased importance due to their current environment: "You know the way they live here in the refugee camp...they have to survive, their livelihood has to be enhanced. So, they gave us feedback that they looked at this as something very positive and are taking it on" (F2).

Regarding the business and economics knowledge the students acquired, the facilitators discussed that students learned they needed to focus their business ideas and specialize in a specific service or product: "...students told us they learned how to

specialize, instead of doing too many different activities. This makes it easier to find a market. It is an important step for them. They are now aware of where to allocate their resources, especially time" (F1). The students also reported that the course motivated their business mindset: "The course taught us how we can manage our resources either in agriculture or other businesses" (S1). A facilitator expanded on this topic, "They got to know how they can predict prices in the market and how to specialize. We had an instance of a student saying they were dealing in three products, but now says he's going to look into the market and what people like most is what he will focus on" (F2). Facilitators also observed an increased desire among students to continue their education and gain access to educational resources through online learning: "They really loved it. They want to experience more because they kept on mentioning that and asking us for other courses" (F1).

Overall, when asked to reflect on the agribusiness content in the course, eight students remarked that the course had met their expectations as they had increased their knowledge of starting and running a business. Two learners took the opportunity to request additional courses in agribusiness in order to continue improving their skills and knowledge in agribusiness. One student shared that their expectations were met because there was more business content in the course than they had expected.

Program Outcomes - Digital Literacy Skills

In both the pre-program and post-program questionnaire, students were asked to rate their skills in three areas of digital literacy: motivation, confidence, and comfort.

For level of motivation to be digital learners (Table 2), results indicated that the biggest change was students moving from 'Somewhat motivated' (37% pre-program; 8% post-program) to 'Motivated' (11% pre-program; 42% post-program). The percentage indicating they were 'Very motivated' or 'Not at all motivated' remained consistent from pre-program to post-program.

Table 2. What is your current level of motivation for digital learning?

Rating	Pre (n=27)	Post (n=24)
Very motivated	44%	46%
Motivated	11%	42%
Somewhat motivated	37%	8%
Not at all motivated	7%	4%

For their digital learning course confidence level, pre-program results were distributed across all four confidence levels (Table 3). At the program conclusion, all students

indicated that they were either 'Very confident' or 'Confident' in digital learning courses (63% and 38%, respectively).

Table 3. What is your current level of confidence in digital learning courses?

Rating	Pre (n=26)	Post (n=24)
Very confident	27%	63%
Confident	35%	38%
Somewhat confident	27%	0%
Not at all confident	12%	0%

For comfort level in digital learning course interaction (Table 4), responses indicated growth in students feeling 'Very comfortable' (37% pre-program; 50% post-program) as well as 'Comfortable' (30% pre-program; 46% post-program). Similarly, questionnaire responses indicated a decrease in students feeling 'Somewhat comfortable' (26% pre-program; 4% post-program) and 'Not at all comfortable' (7% pre-program; 0% post-program).

Table 4. What is your current comfort level in interacting with digital learning courses?

Rating	Pre (n=27)	Post (n=24)
Very comfortable	37%	50%
Comfortable	30%	46%
Somewhat comfortable	26%	4%
Not at all comfortable	7%	0%

Paired t-tests were used to analyze the significance of the results for both sets of questionnaire data regarding digital literacy (Table 5). Students were included in this analysis if they completed both the pre- and post-questionnaires (23 of 30 students).

Analyses indicated all three areas showed statistically significant change (Table 5). Students reported the most change in their digital learning course confidence, ($t(21)=5.01$, $p=.00$). Students also reported statistically significant change in their digital learning motivation ($t(22)=2.55$, $p=.020$) and their comfort level in digital learning course interaction ($t(22)=2.51$, $p=.020$).

Table 5. Paired T-test Results

Survey Question	Survey Timing	Average Rating (1-4 scale)	Change	SD	t	p-value	Significant? ($\alpha = .05$)
What is your current level of motivation for digital learning? (n=23)	Pre	2.83	0.47	0.898	2.554	0.02	Yes
	Post	3.30					
What is your current level of confidence in digital learning courses? (n=22)	Pre	2.59	1.00	0.926	5.006	0.00	Yes
	Post	3.59					
What is your current comfort level in interacting with digital learning courses? (n=23)	Pre	2.87	0.56	1.080	2.510	0.02	Yes
	Post	3.43					

Throughout the program, students took steps to proactively improve their digital literacy. The course designers, consisting of the professor, his teaching assistant, and a member of E4H staff, chose to provide twelve internet-enabled devices for the thirty students; they hoped this approach would encourage students to work and learn together. However, the research found that the limited number of devices was frequently noted as a challenge by students and facilitators. Learners took the initiative to coordinate classroom attendance times so they would each be able to access a device on their own or with one other person. This was driven by students' desire to strengthen their digital literacy skills.

Regarding digital learning, facilitators described the value of a strong, consistent network connection and reliable power, which allowed students to focus solely on the course content. They also described the motivation and commitment of students to complete the course, which they attributed 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). Overall, when reflecting on their digital literacy skills, students attributed their improvement to the fast, consistent, and strong network connection that SolarSPELL provided - a phenomenon not usually available in refugee settlements. One student shared, "The greatest strength was the network speed, which allowed us to use the devices to access the course very quickly without interruption" (S16).

Discussion

As presented earlier, only 3% of refugees have access to HE in comparison to 36% of global youth (Save the Children, 2017; UNHCR, 2019a). Based on these statistics,

UNHCR, the German Federal Foreign Office, and the German Academic Exchange Service set an ambitious goal of increasing refugee participation in HE to 15% by 2030 (UNHCR, 2019a). If academic and humanitarian organizations work to achieve this goal, it offers the potential to increase the topical knowledge and skill base of refugees, and to create a critical mass of community members to pursue, implement, and sustain reconstruction efforts in refugees' home countries via innovative solutions. Within this context, we will now explore more deeply the study's results and findings.

University-level Courses

Despite the numerous barriers that refugees face in accessing HE, this program demonstrated that when these barriers are addressed, refugees are able to succeed in university-level courses. This success should be seen as a welcome sign for academic and humanitarian organizations intent on not just meeting UNHCR's 15% by 2030 goal, but having students succeed in the HE programs in which they participate. Moreover, the program's students were not satisfied with a single university-level course, but expressed interest in pursuing more courses and degree pathways. These students recognized the value HE offers to them in the short-term, as demonstrated by the students applying their newly acquired agribusiness knowledge at the local market. In their request for additional courses and degree pathways, they also recognized the value HE offers for the long-term. As presented in the literature review, the knowledge and skills that refugees gain through HE increase their prospects for personal development as well as the possibility of playing key roles in future reconstruction efforts. Organizations offering HE to refugees should endeavor to stress readily applicable content knowledge and skills in areas important to reconstruction efforts. Additionally, refugee HE programs should adopt a structure that supports inclusivity, tolerance, gender equity, teamwork, and critical thinking and problem-solving skills. Within the program presented here, thirty students from six different countries, both male and female, demonstrated the teamwork and problem-solving skills that will be necessary in future reconstruction efforts and that are nurtured through HE when they proactively coordinated their schedules to improve their digital literacy skills.

Digital Literacy

Knowledge-based economies are now the engine of thriving nations (Van Larr et al., 2017). Higher education prepares refugees for transition into the expanding knowledge-based job market as they gain the confidence, knowledge, and skills necessary for employment (O'Sullivan 2002; Crea 2016). For the reconstruction efforts that await the world's current refugee population, digital literacy skills will be critical to develop, implement, and sustain them. As demonstrated through this study, incorporating innovative technology approaches into HE offerings improved the digital literacy of students. Specifically, students' daily usage, maintenance, and management of the program's smartphones, laptops, and SolarSPELL technology served to improve

students' motivation to be digital learners, raise their confidence in digital approaches to learning, and increase their comfort level with digital learning technology. Improvements in all three of these areas were highly significant, indicating clear and lasting progress. There exists a possibility that providing internet-enabled devices to every student from the program's outset would have strengthened digital literacy skills more than what was measured, and this remains an area for future research. Overall, organizations offering HE to refugees should endeavor to take advantage of students' demonstrated interest in acquiring these skills by incorporating technology into their program structures. This will not only increase students' investment in and dedication to the HE pathway, but will build the digital literacy skills necessary for them to contribute to building a thriving and resilient post-conflict society.

Higher Education in Resource-constrained Environments

In light of current efforts to achieve the #15by30 goal, the results of the SolarSPELL pilot study take on added significance. The 27 current members of the Connected Learning in Crisis Consortium, of which Arizona State University is a co-lead, are universities and education providers that are leading the effort to provide HE in areas of displacement. In order to offer HE programs, these universities have been restricted to operating in refugee communities equipped with computer labs, internet access, and electricity (Gladwell et al., 2016; WUSC 2018). While these efforts should be continued, the lack of an offline solution means that refugees located in low-resource environments will continue to lack access to HE programs. The offline SolarSPELL technology has demonstrated its ability to expand current efforts to offer HE to refugees, and expand the geographic footprint in which HE programs can be offered. This expansion offers an opportunity for these universities, as well as the humanitarian education sector as a whole, to reach the stated goal of 15% of refugees participating in HE by 2030. As the literature presented here has demonstrated a connection between participation in HE, development at the individual and community levels, and reconstruction at the national level, future reconstruction efforts will benefit from having more refugees participating in HE programs. Moreover, expanding HE access for refugees in low-resource environments are of particular importance, as future reconstruction efforts in post-conflict societies will need individuals with university-level education, and the knowledge and skills that go along with it, represented in all areas of the economy, if these efforts are to be sustained long-term. This pilot program has demonstrated an option to achieve this with marginalized refugee populations, to meet the #15by30 goal, and to meet the needs of national post-conflict reconstruction efforts.

Conclusion

The purpose of the program was to grow the agribusiness knowledge and digital literacy skills of 30 refugee learners of Nakivale settlement, Uganda who participated

in Arizona State University's AGB250: Agribusiness course via the Education for Humanity: Powered by SolarSPELL technology. The program was small in scope (reaching 30 refugees) and limited in reach (confined to the Nakivale community in the refugee-friendly country of Uganda), and additional analysis from future implementations of university courses utilizing the SolarSPELL offline technology will be needed to increase the validity of the results. Improvement in the area of students' soft skills were not measured through the study, but were evident in the qualitative themes that emerged. Future implementations of the program will need to assess the growth of students' soft skills, as the literature has demonstrated their importance in successfully implementing and sustaining reconstruction efforts. Additionally, longitudinal studies will be critical to determine the extent of the connection between refugee higher education at the individual and community levels and the success and sustainability of reconstruction efforts at the national level.

Utilizing the socio-ecological model to frame the results, the study demonstrates the ability of HE delivered via offline technology to build the following knowledge and skills of refugees at the individual level, which will be necessary for future reconstruction efforts at the community and national levels: topical content knowledge and digital literacy gained directly from university-level courses, and critical thinking, problem-solving, teamwork, and collaboration skills strengthened through program participation. This result is relevant to all academic institutions and humanitarian organizations committed to achieving UNHCR's pledge to increase refugee participation in HE from 3% to 15% by 2030, and to current refugees who will implement and support the future reconstruction efforts of post-conflict societies.

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