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Cross border connected learning in northern Syria: An agricultural pilot study



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ABSTRACT

Prior to 2011, public universities and private institutions in Syria were the main sources of knowledge and skills training for industry and agriculture. Due to the ongoing conflict and humanitarian crisis however, the country's education system has been decimated at all levels, with disastrous effects for the nation's knowledge base and training provision. To address these circumstances, strategies and methods for effectively re-skilling and up-skilling the agricultural workforce inside Syria are urgently needed. Traditional face-to-face models of education are difficult to implement due to conditions of conflict. This action research project centres on the delivery of participatory e-learning courses by Syrian academics in exile to learners inside Syria. In this paper, we describe and evaluate the delivery of a 5-week pilot course on Soilless Cultivation Systems. In addition to delivering an effective course, we sought to understand the challenges associated with distance learning in the Syrian context, to inform further development of approaches that can surmount these challenges, and which might in due course be extended into other areas beyond agricultural engineering. Accordingly, we developed a course that at (a) constituted a meaningful educational experience for learners; (b) facilitated the trial of a range of pedagogical approaches; and (c) allowed for the collection of evaluative data to inform subsequent learning design. Findings highlighted the challenges of achieving applied relevance without laboratory or field access, meeting the needs and expectations of diverse learners, and facilitating sufficient interaction between learners and the lecturer. Possible strategies to address these issues include use of high-quality video and images and planned use of routine social media technologies to facilitate parallel networking and resource share.

1. Introduction

Despite reforms between 2006 and 2010 which positioned universities as the key providers of knowledge and skills for the industrial and agricultural sectors (Milton, 2019), Syrian higher education prior to 2011 suffered from a lack of practical relevance. Dillabough et al. (2019) extensive study of Syrian higher education post-2011 found that 'universities played little or no role in providing practical skills or training to support student transition into an already tight labour-market' (p.84). Since 2011, the nation's knowledge base and academic infrastructure has been severely damaged, exacerbating these pre-existing limitations. Tens of thousands of university students have had no choice but to suspend their studies, for many reasons including risks associated with travelling, injury, escape from military service, and internal displacement. Industry has also suffered, and graduates have limited opportunities to apply their theoretical knowledge in professional practice. The cumulative effect is that Syria's working pop-

ulation is rapidly deskilling. At the present time, (former) students and graduates face significant barriers to skills development, which in turn puts work opportunities and livelihoods at risk. In addition, life in Syria has changed dramatically over the course of eight years of conflict, and unanticipated challenges have emerged that pre-2011 higher education curricula were not intended to address.

The consequences of this damage to the education sector have been particularly profound for the agricultural sector. Agriculture is Syria's primary industry, accounting for 26% of GDP and the main source of income for more than 65% of the Syrian population (FAO, 2017), as well as providing vital food resources at a time of crisis. As with other sectors, agriculture needs skilled engineers to address various challenges brought about by conflict, such as contaminated agricultural land and unprecedented increases in regional populations due to internal migration.

Strategies and methods for effectively re-skilling and up-skilling the agricultural workforce inside Syria are urgently needed. Traditional

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face-to-face models of education are difficult to implement in Syria, due to factors including the destruction of educational infrastructure inside the country, the flight of educators as refugees, and safety concerns limiting learners' access to physical learning environments. Distance learning approaches offer potential means to overcome these challenges.

Huge swathes of Syria's academic workforce and skilled experts have fled to neighbouring countries since 2011, compounding the knowledge deficit inside the country. Yet many academics in exile are committed to supporting education in Syria (Dillabough et al., 2019; Parkinson et al., 2018; Parkinson, McDonald & Quinlan, 2019), and are actively seeking to connect with learners inside Syria and deliver courses from third countries. Exiled academics constitute an underused resource that can be leveraged through distance learning. This action research project centres on the delivery of participatory online learning courses by Syrian academics in exile for learners inside Syria, starting in the field of agricultural engineering. In this paper, we describe and evaluate the delivery of a short, 5-week pilot course on *Soilless Cultivation Systems* to learners inside Syria. In addition to delivering an effective course, we sought to understand the challenges associated with distance learning in the Syrian context, to inform further development of approaches that can surmount these challenges, and which might in due course be extended into other areas beyond agricultural engineering. Accordingly, we developed a course that at a) constituted a meaningful educational experience for learners; b) facilitated the trial of a range of pedagogical approaches; and c) allowed for the collection of evaluative data to inform subsequent learning design.

In the following section we describe the impact of conflict on the higher education and agricultural sectors in Syria. We then consider the growth of distance education as a field of research and practice and its implications for cross-border and borderless education and discuss the potential of online models for delivering higher education and specialist training in a conflict context. In the subsequent methodology section we first discuss the design and delivery of the 5-week pilot course, before outlining our approach to data collection and analysis. We go on to present the findings and discuss them relation to the research questions, and account for the limitations of the study. Finally, we consider the study's implications for the subsequent development of distance courses for learners inside Syria, and for education in crisis contexts more generally.

1.2. Syrian higher education since 2011

Eight years of conflict in Syria has resulted in hundreds of thousands of deaths and the displacement of millions internally and across the globe. Syria's higher education sector has been decimated and teaching and learning have suffered from severe disruption. While reports of Syrian higher education's total collapse are exaggerated, and the remnants of pre-war higher education remain 'by far the most significant form of higher education inside Syria' (Milton, 2019, p.38), such provision is overwhelmingly located within regime-controlled areas and is thus inaccessible to learners in the Northern regions of the country, where provision is minimal and operates under extreme resource constraints (Dillabough et al., 2019), often without even dedicated teaching spaces. In any case, the quality of provision across the entire country has been severely eroded, and attendance rates have fallen drastically due to safety concerns and other factors, even if quantitative statistics suggest the maintenance of a healthy sector on paper (Milton, 2019). Chronic problems that predate the crisis, such as outdated teaching methods, curricula and texts a lack of student-centredness (Milton, 2019), inequality of access and corruption and bribery (Dillabough et al., 2019) endure and are in many cases exacerbated under conditions of frozen conflict and fragile peace.

As previously stated, thousands of former students have suspended their studies since the crisis began, and graduates have suffered from a lack of opportunities to apply their knowledge in professional contexts, inevitably leading to deskilling across the industrial and agricultural sec-

tors. The detrimental impact of deskilling on these sectors has occurred alongside direct shocks in the form of physical damage to land and infrastructure and unprecedented demand for products, which have given rise to extreme or fragile conditions that the Syrian education system did not anticipate or account for.

1.3. Syrian agriculture post-2011

Syria was once considered the "breadbasket" of the Middle East and one of its largest exporters of livestock, crops, and vegetable and horticultural products. It is currently in a state of acute food insecurity and is dependant on imports of food. The conflict in Syria has had a devastating impact on agricultural capacity, resulting in \$16 billion total losses between 2011 and 2106, including more than \$3 billion losses in infrastructure such as irrigation canals, wells and veterinary infrastructure. Food prices are estimated to have increased by 800% since 2010. As a result, it is estimated that 6.5 million people inside Syria are currently food insecure and a further 4 million people are at risk of becoming acutely food insecure (FAO, 2017; Global Communities, 2018; Zurayk, 2013). Despite sustained crisis since 2011, agriculture is still considered an important part of Syria's economy and critical for self-sufficiency for more than 75% of households who grow their own food for consumption (WFP, 2010, FAO, 2017; FAO 2018; FAO, 2019; OCHA, 2017; OCHA, 2018). Rebuilding this sector will be one of the most important elements of a transition strategy towards reconstruction and peace but will require an appropriately skilled workforce. Re- and up-skilling the agricultural workforce inside Syria must therefore be a development priority.

1.4. Cross border connected learning

Advances in educational technology over the last two decades have supported a growth in 'cross border', 'borderless' and 'offshore' educational provision. These terms, which each possess particular connotations and ideological nuances (Kosmützky and Putty, 2015), all refer to forms of educational delivery in which learners, teachers and providers can be in different geographical locations. Knight (2014) notes that technology has broadened how educational mobility is conceived beyond the notion of the mobile learner to encompass the mobile programme and mobile provider. The term 'cross-border' education in particular is associated with programme and provider mobility (Kosmützky and Putty, 2015), as is the case in the present study in which the providers—that is, Syrian academics in exile—have moved beyond the Syrian border. Meanwhile the term 'connected learning' has been used to describe models of higher education delivery in refugee contexts 'that leverage information technology to combine face-to-face and online learning, otherwise known as blended learning' (INEE, 2019, n.p). The combination of online delivery, fixed learning spaces and in situ teaching assistants in the course detailed in this study align with this description, though the course providers, and not the learners, are the refugees. On the basis of these existing taxonomies, we use the compound term 'cross border connected learning' (hereafter CBCL) to describe the approach used.

1.5. Technology and learning

Of particular relevance to this study is that information technology can facilitate access to education by hard-to-reach populations, whether through personal devices, internet cafes or—as in the case of this study—designated learning labs (Rajab, 2018). However, as Dahya (2016) notes in her landscape review, although delivering education in development, conflict and crisis contexts is increasingly acknowledged as global challenge priority, there is a lack of research-based evidence concerning the effective use of educational technology in such contexts.

Table 1
Learner's distribution according to community centre, gender, and education level.

Community centre	Gender		Education		Total
	Male	Female	Students	Graduate engineers	
A	14	0	2	12	14
B	18	2	8	12	20
C	12	8	11	9	20
Total	44	10	21	33	54

The effectiveness of technology in education is commonly evaluated in terms of *enhancement* (Kirkwood & Price, 2014). While focus on the extent to which technology enhances learning is important, *enhancement* is an inherently comparative notion, since it refers to an 'increase or improvement in quality, value or extent' (p.7) from a predetermined and existing baseline. Opportunities for comparative analysis in our study were limited, as there was little existing provision against which to evaluate our intervention. In contexts such as Northern Syria, where opportunities to engage in traditional face-to-face education are severely limited, it is more pressing to first ask whether technology can *enable* learning. For the purposes of this study therefore, we needed to consider both the potential of online technologies to enable effective learning and, looking forward to future educational interventions, how the approaches used in this pilot course might be subsequently enhanced.

2. Methodology

The course evaluation reported in this paper sits within a wider ongoing action research project. Action research is intended to solve actual problems encountered by target populations and to directly improve their circumstances in relation to the phenomenon under focus (Mills, 2014). Following this principle, action research findings are directly applied to inform changes to practice in the field, though they can also lead to transferable insight of relevance to wider contexts. Action research projects commonly follow an iterative, cyclical structure comprising phases of *planning*, *acting*, *observing* and *reflecting* (see e.g. Kemmis & McTaggart, 1988). Each completed cycle informs the next cycle, and thus promotes longitudinal improvement. This paper documents the first cycle of this ongoing project, beginning with initial reconnaissance and course design (*planning*), the delivery of the pilot course (*acting*), data collection and analysis (*observing*) and insights gained/lessons learned (*reflection*).

The study was guided by the following research questions:

- *What are Syrian agricultural learners' experiences of CBCL?*
- *What are the barriers to effective CBCL in Northern Syria?*
- *How can barriers to effective CBCL for agricultural learners in Northern Syria be addressed?*

2.1. Course design and delivery

A pilot online course of five weekly sessions on the subject of *Soil-less Cultivation Systems* was delivered to learners inside Northern Syria by Syrian academics in exile in Turkey during late 2018. To ensure the programme aligned with the needs and standards of stakeholders in academia, the agricultural sector and civil society, the course was devised and delivered in cooperation with regional community centres, NGOs, CSOs and professional bodies (namely Balad Syria Organization, Shafaq Organizaton, Rahma Relief Foundation, the Council for At Risk Academics and the Agriculture Engineers Association). The syllabus centred on content relevant to the current Syrian reality of fragile food security and widespread agricultural damage.

Based on our understanding of commonly used digital technologies inside Syria, and also given the cost, infrastructure and training implications of using sophisticated educational technologies, we decided to market the course using well-known technologies and social media

platforms (Facebook and WhatsApp) and through partner organisations. Participant registration was carried out using Google Forms. Although we announced that there was capacity for only 45 participants, 159 enrolment requests were received. Therefore, in order to ensure that the target learners were prioritised, and to account for known inequalities in access to education in Syria, participants were selected according to the criteria of gender, age, and education status (engineer/student). All enrolment requests from female applicants ($n = 10$) were accepted, and priority was given to students ($n = 21$) and recent graduates ($n = 33$), on the basis that they have not benefitted from in-work training since completing their studies and are at higher risk of deskilling. Ultimately, we were able to deliver the course to 54 learners across the three centres (Table 1). The median age of learners was 29.5, the oldest being 20 and the youngest being 39.

Three community centres in different locations in North-West Syria were checked for the requisite teaching conditions and security standards. Thorough testing of the centres' internet connections was particularly important to ensure that it was strong enough to support video stream broadcast. We also needed to ensure that the community centre assistants were sufficiently familiar with the equipment and the software used for the delivery of the course.

The five sessions on "soilless cultivation systems" were streamed live via Adobe Connect to the community centres, and the lecture portion of the sessions were recorded and subsequently published on social media and on YouTube to allow for wider access. In order to trial a variety of pedagogical approaches and tools across the course, each session was designed differently (Table 2). Although inevitably at the expense of consistency of approach across the course, this allowed us to collect feedback from learners relating to their perceptions of the accessibility and quality of different approaches. WhatsApp groups were created for each centre to distribute materials prior to and following each session.

2.2. Data collection and analysis

Qualitative data were collected using open questionnaires and focus group interviews. Participants were provided with information sheets and consent forms detailing the aims of the study, data handling, anonymity and confidentiality safeguards, and dissemination plans. Participants' right to withdraw at any time was made clear at every point of data collection.

2.3. Questionnaires

A questionnaire was circulated to learners immediately following each of the five sessions and completed by learners at the community centres. The questionnaire comprised three open questions regarding perceived strengths and weaknesses of the session, and suggestions for development (see appendix). Data-driven coding frames (Cohen, Manion & Morrison, 2011) was created inductively for each of the questions through initial readings of the questionnaire data. Data were subsequently coded into the frames and the frequency of recurring themes highlighted by participants were recorded for each session and for the course as a whole (see Tables 4, 5 and Table 6).

Table 2
The delivery approach, tools, and section contents of the e-learning course on the subject of Soilless Cultivation Systems.

Session	Delivery approach	Resources/tools	Section content
1	Live-streamed lecture followed by webinar discussion with course leader	PowerPoint presentation with still images	Introduction into greenhouse cultivation methods.
2	Live-streamed lecture followed by webinar discussion with course leader	Short videos and PowerPoint presentation with still images	Introduction into soilless agriculture types, features and substrate cultures.
3	Flipped classroom (advance reading followed by webinar discussion with course leader)	Relevant website, PowerPoint presentation and pre-recorded videos	Hydroponic cultivation systems, aeroponics, applications
4	Pre-recorded video lecture followed by webinar discussion with course leader	Pre-recorded video lecture	Nutrient solutions, contents, preparation, applications
5	Face-to-face lecture delivered by teaching assistants at each centre, followed by webinar discussion with course leader	Lecture delivered by trained assistants (TOT) – webinar – video – pictures – discussion	Hydroponics applications, examples, course-level discussion

Table 3
Focus group participant’s distribution according to gender and education level.

Focus Groups	Gender		Education		Total
	Male	Female	Students	Graduate engineers	
1	0	8	6	2	8
2	6	2	4	4	8
3	10	0	4	6	10
4	8	0	4	4	8
Total	24	10	18	16	34

2.4. Focus groups

Four focus group interviews with between 8 and 10 participants were conducted following the final session (Table 3).

Interviews focused on learners’ experiences of the content and pedagogical approaches used, and challenges, needs and opportunities relating to learning (see appendix A). Data from the focus groups were analysed thematically using general a general inductive approach (Thomas, 2006). This involved reading the data repeatedly to identify recurrent themes, categorising the data according to those themes and gradually refining the thematic categories until they were felt to accurately and comprehensively depict the range and priority of concerns conveyed by participants. Indicative verbatim quotations were chosen to represent the themes. To ensure inter-rater reliability, two members of the research team undertook initial thematic categorization of one focus group transcript independently, before comparing the results. A high degree of consistency was achieved, and the remainder of the categorization process was undertaken collaboratively.

3. Results

In this section of the paper we present the findings from each data collection method in turn, before triangulating the findings and addressing the research questions in the subsequent discussion section.

3.2. Questionnaire findings

Questionnaire data offered insight into learners’ experiences of each session. Key findings arising across these data included learners’ perception of the value of visual resources (e.g. ‘include additional videos and pictures showing the practical application of hydroponics’); their desire for increased interaction with the lecturer (e.g. ‘interaction between the lecturer and the trainees’; ‘not enough communication with the lecturer’), and their desire for practical training over theoretical content (e.g. ‘the lack of practical relevance’; ‘increase the practical focus’; ‘too much information’). The data-driven coding frames, with indicative quotations and the frequency of responses for each of the five weekly sessions are recorded in Tables 4, 5 and 6.

3.3. Focus group findings

Findings of the thematic analysis of focus group data are presented below under the following thematic categories: *motivations; new knowledge; pitching of the course level; pedagogy; and barriers and constraints.*

3.3.1. Motivations

Participants reported various motivations for engaging in the course. Participants who were working as agricultural engineers saw the course as a continuous professional development opportunity, while others who were qualified as agricultural engineers but working in different sectors were keen to update their knowledge, believing it would enable them to resume employment in the agricultural sector:

We [currently] work away from agriculture because we cannot [find] work in agriculture. [...] We are agriculture graduates and want to work in the field of our specialisation, especially with regard to humanitarian responses (FG1)

Some who had suspended their higher education before graduating saw it as a chance to refresh their knowledge:

I’m very interested in hydroponics and this course helped me to review the knowledge on protected agriculture that I took during my studies which were cut off, and also increased my knowledge about methods and areas of use of aquaculture (FG4)

Other participants however reported that their principal motivation for undertaking the course was to learn about hydroponic farming for subsistence, rather than (or in addition to) professional purposes:

We see the possibility of this knowledge being both a source of food and of work for us (FG4)

[and]

I sought aquatic farming knowledge to help me produce vegetables and food for my family, and maybe a source of income for my family (FG4)

3.3.2. New knowledge

The majority of participants valued the focus and content of the course, and felt it gave them new knowledge. For example:

It was new science that we have never learned about during our studies at the university. I’ve only heard about these methods on some radio programmes before (FG3)

[and]

We learned about nutrient solutions and their applications. I benefited greatly [...] as previously I didn’t know the nutrient solution, what the components are or how to prepare [it] (FG1)

In particular, some participants reported that they had increased their understanding of the potential for applying soilless approaches in agriculture, beyond crops they had previously associated with such methods:

I thought [hydroponic methods’] applications were limited to ornamental plants. I did not expect to have applications for vegetable production or agriculture (FG2)

[and]

Table 4
Responses to Q1: what are the strengths of this session from your point of view?

Indicative responses	Frequency of responses per lesson				
	1	2	3	4	5
'The teaching style'	8	15	16	14	11
'The quality of the materials'	9	7	9	9	10
'The relevance of the content'	2	12	8	1	5
'Clarity of images and diagrams'	5	7	12	5	10
'Good use of video'	2	12	8	1	5
'Interaction between the lecturer and the trainees'	4	4	4	8	7
'Expertise of the lecturer'	6	4	2	2	2
'Being able to learn remotely'	1	1	2	2	

Table 5
Responses to Q2: what are the weaknesses of this session from your point of view?

Indicative responses	Frequency of responses per lesson				
	1	2	3	4	5
'Nothing'	8	14	17	19	18
'Not enough communication with the lecturer'	7	10	9	2	3
'The lack of practical relevance'	3	9	5	7	4
'Technical issues ['software' and/or 'internet connection']'	16	4	4	1	2
'Too much information'	3	5	7	3	3
'Not enough videos'	4	1		2	1
'The lecturer was not physically present'	2	3	1	1	1
'Not enough images'	2				1
'The classroom'	1		1		
'The small size of the text in the PowerPoint slides'			1	1	
'The time of the lectures'	2				

Table 6
Responses to Q3: what are your suggestions for developing this session in the future?

Indicative responses	Frequency of similar responses per lesson				
	1	2	3	4	5
'Increase the practical focus'	16	20	16	18	22
'Include additional videos and pictures showing the practical application of hydroponics'	6	5	5	7	5
'Have the lecturer present in the classroom'	7	6	4	2	2
'Increase course length'	5	5	3	4	4
'Have a device for each learner'	2	5	3	4	3
'Provide further training courses on other relevant topics'	1	3	2	1	4
'Ensure higher quality of internet connection'	7	3			
'Increase the role of the facilitator in the classroom'	2		2	2	2
'Make the course available to more learners'	2	1	2	1	

I did not expect that hydroponic farming could occur in large cultivation areas including many crops and plants, but only at a small level at home (FG2)

3.3.4. Pitching of the course level

However, there were differences of opinion concerning the appropriate level of the course, in terms of complexity of content and the prerequisite knowledge required. For example, some student participants who had anticipated that the content would be beyond their level of understanding had welcomed the simplified, applied nature of the course:

We thought it [would be] difficult, but the trainer helped us to simplify the content to [make it] applicable with simple tools (FG1)

[and]

I learned a lot of skills in hydroponics and it became clear to me that the subject is not complicated and does not require great effort, unlike what I expected (FG4)

Others however had hoped for more practical instruction relating to installing and operating hydroponic systems and found the scientific aspects of the course to be unnecessary. For example:

I was expecting to come away with ideas about the economic feasibility and the minimum cost of [setting up] a production unit, rather than going into finer scientific details (FG2)

On the other hand, some qualified engineer participants had found the level to be low:

We [already] know the basics of hydroponics and it doesn't differ that much from normal agriculture (FG2)

[and]

My expectations were a little higher; to get into the nutritious structures of each crop more, as well as the nature of plant growth...I mean an advanced course for those who have preliminary knowledge of this [type of] planting. We hope another course will be offered soon (FG2)

[and]

The scientific level should be targeted to the audience, for example students or engineers (FG2)

3.3.5. Pedagogy

Direct engagement with the trainer and opportunities for group interaction emerged as the most valued pedagogical aspects of the sessions. For example:

[I appreciated] acquiring new information from the trainer, in addition to drawing on the ideas of other trainees. [...] I have benefitted greatly from the discussion that took place between us trainees together (FG4)

[and]

During the last lecture the interaction was wonderful. We were able to direct our questions to the lecturer and got good response and discussion (FG4)

Some participants felt that opportunities for direct interaction had been lacking in some of the sessions and recommended that in future the course team should 'increase direct communication between the trainee and the lecturer'. It was noted by a number of participants that the reliance on shared laptops at each training centre, owing to the limited number of individual logins supported by the Adobe Connect license, had inhibited direct interaction amongst trainees. For example:

The lack of direct voice communication between the trainee and lecturer, where each trainee has his own laptop and could speak and hear directly, limits the interaction amongst trainees. The capacity of the program currently does not allow this, and we were seated in rows (FG2).

Others however had found that the number of laptops was sufficient to support direct interaction with the lecturer:

The interaction was excellent in terms of communication and we were able to interact directly with the lecturer because he had every 3 trainees for a laptop (FG1)

Some participants reported that the videos and photos in particular had been key to highlighting the possible applications of hydroponic farming:

We learnt a lot, especially through the pictures and videos, about the possibilities of producing vegetables in places we did not expect, such as a courtyard, balcony or roof (FG1)

[and]

I benefitted from the videos which increased my understanding of producing vegetables in small areas (FG2)

Participants in all focus groups however identified the lack of practical activities as a shortcoming of the course. As the technologies and farming methods were new to the majority of trainees and not widespread in Syria, the trainees did not have access to real examples of soilless systems, and the short time span of the course did not allow for practical tasks to be undertaken between sessions. Several participants recommended that physical training centres be set up where trainees could apply their learning in practical projects:

[We would like] the possibility to cooperate with each other as a team, to establish a unit for aquaculture as a participatory project amongst trainees (FG2)

[and]

There should be a practical application, for example the course should end with a project for each group of trainees (FG1)

[and]

The course should have practical activities on the ground (FG4)

Some participants spoke of the need for ongoing supervision by experts to support effective realisation of the technologies and methods taught on the course:

We can apply what we've learned, but we want an expert in aquaculture to supervise any project, even if it was at home, because we're still at the beginning of the road (FG1)

[and]

We need training on the application of what we learned in these sessions, through an applied project under supervision of a doctor (FG4)

[and]

Assign the trainee a tutorial at the end of the session to discuss with the lecturer and colleagues, to develop their ideas (FG2)

3.3.6. Barriers and constraints

Linked to the issue of a lack of practical opportunities to apply their learning, resource constraints emerged as a major barrier to applying learning. One participant asserted that without money it was impossible 'even to launch a simple, small project', while others spoke of being unable to access the necessary materials, and emphasised their need for direct financial support:

We see the possibility of applying [these methods], but they need financial support (FG3)

[and]

The financial challenge is great, and we must have a project that supports us with the raw materials to build a small water farm (FG3)

[and]

I've learned the basics of hydroponics and the materials I need are available on the market, but the financial factor remains a challenge I cannot ignore (FG4)

[and]

It cannot be applied at present because of the lack of necessary tools and raw materials, especially to make the required nutrient solutions (FG4)

Some participants identified the timing of the workshops as a potential barrier to engagement, though conversely others appreciated the scheduled times. Despite extreme care being taken in cooperation with local organisations and communities when choosing the community centres, one participant reported security concerns:

The training venue is far from my place of residence, so I was afraid to attend because of the lack of public transport (FG4)

4. Discussion

The findings presented in the previous section offer valuable insight into learners' experiences of CBCL in northern Syria, helping to address the deficit in the evidence base surrounding education in crisis conflicts identified by [Dahya \(2016\)](#) and others. Despite some important shortcomings, discussed below, participants acknowledged having gained valuable new knowledge and enhanced their understanding in the areas covered by the course, suggesting that the pilot course was effective in enabling learning. This lends support to arguments (e.g. [Rajab, 2018](#)) that online technology offers a means for surmounting barriers to education for hard to reach populations. Furthermore, that we were able to deliver cross-border training in a field directly pertinent to challenges brought about by conflict, namely food insecurity and agricultural damage, suggests the potential of CBCL in building affected populations' capacity to recover from crisis, mitigating for the depletion of expertise ([Parkinson et al., 2018](#)) and reconnecting displaced experts with communities of learners and stakeholders.

In highlighting strengths and weaknesses in the design, delivery and content of this pilot course, the findings suggest several areas for improvement going forward. Firstly, questionnaire and focus group responses revealed participants' anxieties concerning the lack of practical focus and limited opportunities to apply newly-acquired theoretical knowledge, and a desire for modes of instruction that could better facilitate these aspects. As noted, lack of practical relevance was a feature of Syrian higher education pre-crisis and opportunities for agriculture graduates to apply their knowledge in professional settings have been limited since ([Dillabough et al., 2019](#)), and these findings suggest that the online approaches piloted in the course do not, alone, offer an adequate solution to this issue. On the other hand, safety concerns limit possibilities for practical instruction or visits to field sites, as were suggested by respondents. While the alignment of theory and practice is a particularly pronounced challenge in Syria ([Dillabough et al., 2019](#)), it is likely to be encountered in other contexts where access to physical educational infrastructure has been impacted by conflict, and thus warrants dedicated attention and comparative analysis going forward. The use of high-quality images and videos featuring practical examples of hydroponic systems were valued by participants, suggesting that including more visual content in courses might help to foreground applied relevance.

Direct interaction with the lecturer, also identified as a strength (and lack thereof as a weakness) in questionnaire and focus group responses, might also help to compensate for the lack of practical activities by giving learners more opportunities to directly seek the lecturer's advice about the practical application of theoretical knowledge. While poor internet connectivity inhibited interaction and is a factor largely beyond the control of the course team, there is scope for designing the sessions to

better mitigate for connectivity issues and facilitate interaction via other channels. Whatsapp groups initiated by the course team were intended primarily to disseminate materials during the course, but were unexpectedly used as fora for discussion between participants during and beyond the course. Incorporating Whatsapp or other habitual technologies more formally into the design and delivery of sessions might provide a means for participants to interact with the lecturer that does not require strong internet connectivity. These considerations would need factor in local connectivity and data security issues in different global contexts, as well as learners' technological resources and literacies.

A related issue that warrants further attention is whether delivering courses via livestream to community centres is preferable to delivering courses to individual learners' devices, and/or whether it is feasible to do both simultaneously. Sporadic internet connectivity inside Northern Syria, limited access to laptops and restrictions on the number of attendees under the software license were all limiting factors influencing our decision to deliver the course to community centres, together with the wish to provide an interactive, as opposed to pre-recorded, experience. However, insights arising from the questionnaire and focus group data suggest both strengths and limitations to this approach. As already noted, learners valued interacting with the lecturer but some also felt that the level of interaction was insufficient (or wanted more). Specifically, some learners expressed a preference for individual devices in order to be able to interact with the lecturer directly. While access to laptops is limited in Northern Syria, smartphones are common and might provide a means for individuals to access courses. However, participants also valued the opportunity to interact *with one another*, which occurred as a direct result of their coming together at the community centres. Moreover, while the shared location limited access to the course due to capacity issues, delivering a course remotely to individual learners would render it inaccessible to learners without devices. Again, while these findings reflect the specific circumstances of the Northern Syrian context, this dilemma is likely to resonate with the experiences of learners and educators working in comparative contexts, and further, comparative consideration should be given to how an appropriate balance might be struck, and to the possibility of hybrid models.

Questionnaire and focus group data indicated that learners valued, and were motivated by, the opportunity to acquire new knowledge and benefit from the lecturer's expertise. However, there were concerns about the amount and level of content delivered. The course was marketed to students and graduates, and focus group data suggested that these different groups had different expectations and needs, despite efforts to make the content accessible and valuable to both. This highlights a problem arising from Syria's higher education system being disrupted, and further consideration of how to differentiate between learners as far as possible given resource and other constraints is needed. More broadly, it brings us to consider whether and how CBCL can meet the needs of diverse learners in crisis contexts, where institutions and systems that previously facilitated scaffolded or level-benchmarked education have ceased to function. While the course piloted in this study was synchronous and linear in design, asynchronous models can support differentiation and the engagement of diverse learners and can also address issues of scheduling which can disadvantage learners within cohorts (Bali & Meier, 2014). Incorporating and evaluating asynchronous elements, or evaluating comparative synchronous and asynchronous interventions, will help to build the sparse evidence base (Dahya, 2016) and reveal advantages and disadvantages in this regard.

As a first cycle of action research, this study has highlighted clear areas for development for subsequent iterations, and we intend to continue to work closely with NGO partners to facilitate practical training. It is hoped that for subsequent iterations of the course, a quasi-experimental approach involving pre- and post-testing and a control group (who would themselves have an opportunity to undertake the course later) will enable us to assess learning gain statistically.

Conflict contexts such as Syria present additional challenges to those associated with online learning in better resourced contexts, yet such

contexts are often where opportunities to learn are most needed. Collaborations between displaced academics or other experts and organisations working on the ground are needed and should be evaluated and disseminated to contribute to a knowledge base to inform similar interventions globally.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

A: Focus group question list

- What did you expect from this course?
- Did you benefit from this course in general? If so, how?
- Is it possible to apply what you have learned from this course? Why?
- What difficulties did you encounter in this course?
- What are your needs in upcoming courses?
- Do you have suggestions to improve such courses?

B: Questionnaire open questions

- What are the strengths of this session from your point of view?
- What are the weaknesses of this session from your point of view?
- What are your suggestions for developing this session in the future?

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