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Before the COVID-19 crisis, in-person engagement was the main method of ensuring community participation in participatory research processes. However, the pandemic accelerated the switch to digitally-mediated participatory research methods (DMPRMs). This article presents a case study of a digitally-mediated, human-centered design (DMHCD) process enhanced by digitally-mediated community-based participatory research approaches (DMCBPR) as part of our efforts to develop a digital access-to-justice platform for military veterans and their families. We reflect on our experience of enhancing DMHCD with DMCBPR approaches and include insights about how to facilitate the transition from in-person HCD+CBPR to DMHCD-DMCBPR. We also discuss the dual challenges of combining two different approaches while shifting to a virtual/online participatory research framework. Finally, the present study aims to achieve the following objectives: first, to add to a small—but growing—body of research around digitally-mediated participatory research methods; and second, to add to the emerging literature on HCD+CBPR integration approaches to design interventions for underserved populations.

Introduction

The Veterans Legal Link (VLL) project, an Aberystwyth University initiative, was established in 2015 to meet a growing need for free legal advice and assistance to veterans following quickly expanding advice deserts developing in England and Wales as a result of the cuts to legal aid implemented by the Legal Aid, Sentencing and Punishment of Offenders (LASPO) Act 2012 which directly impacted the veteran community. In particular, the effects of LASPO were quickly felt in Wales as broad areas of law were removed from the spectrum of advice that was previously available to underserved populations including military veterans and their families. The Veterans Legal Link sought to address these advice deserts by providing free legal advice, casework, and signposting for veterans and their families. The VLL has provided legal services and casework for more than 1,000 veterans since its creation and through this project, we have provided both immediate and long-lasting impacts for our service users, as evidenced by their effusive thanks and feedback:

> *"Our beneficiary... following prompt legal advice and assistance, he was able to regain control of his company and avoid both the dissolution of the business and the loss of the assets attached to the company." -Companies Law Client*
>
> *"Thank you for your prompt action I'm so grateful for your help and support. The situation has put me back in bed with my mental health." -Wills and Probate Client*
>
> *"I genuinely have never felt so frustrated and sad with what is going on right now.... I can't believe it. Many thanks for your reply!" -Child Contact Client*
>
> *"Our beneficiary was stopped... and his vehicle was seized due to showing no insurance... it was discovered that a change in policy had not taken place, and therefore the vehicle was showing as uninsured,,, the insurance company admitted liability and agreed to backdate their insurance to the relevant date, and our beneficiary was able to keep his driving license and avoided an unnecessary appearance at the Magistrates Court." -Criminal Litigation Client*

Our clients include both men and women between the ages of 25 to 70, from primarily socio-economically disadvantaged backgrounds. Some clients have additionally demonstrated needs within the spectrum of mental health, addiction, aggression, and reintegration which have necessitated referrals to both legal and non-legal service providers catering to these complex needs. These clients are often located in rural Wales, where there are barriers to accessing legal services, such as long distances and lack of transportation. As part of our ongoing work to provide justice access, we outline the methodology taken for the creation of an online access-to-justice portal centered around the principles of human-centered design (HDC) and its enhancement by using community-based participatory research (CBPR).

HCD and CBPR are two problem-solving approaches that could be used to develop solutions to improve access to justice. Both participatory research methods call for a partnership approach to research where academic partners equitably involve community members in all steps of the research process to achieve their respective goals. HCD has been conceptualized as "reflecting the influence of participatory approaches *and* a scientific approach to user research" (Kane, 2020, p. 489). Its main goal is to create widely usable and useful products and services by putting users at the center of product design and development. This is achieved through the following steps: 1) identifying the users; 2) specifying their needs and requirements; 3) producing design solutions; and 4) evaluating design solutions against those requirements. However, owing to HCD's commercial orientation, the emphasis is on generating and developing creative ideas and rapidly turning them into tangible products that are easy to operate and valuable to users (De Vito Dabbs et al.,

List of Abbreviations

Abbreviation	Meaning	Page
VLL	The Veterans Legal Link	
HCD	Human-centered design	
CBPR	Community-based participatory research	
DMPRM	Digitally-mediated participatory research methods	
PRM	Participatory research methods	
CAB	Community Advisory Board	
CSCW	Computer-supported collaborative work	
NCCB	Newark Community Collaborative Board	
ASRH	Adolescent sexual and reproductive health	
BOS	Bristol Online Survey	

2009). In contrast, CBPR has been primarily employed by academics as part of university-community research partnerships—hence, its focus is on generating local data that inform local problems (O'Brien & Whitaker, 2011). Important principles to keep in mind when applying CBPR approaches to problem-solving include defining the community, developing shared trust and goals in community partners, and shared continuous engagement and collaboration by all partners. Thus, CBPR moves at a slower pace than HCD. However, despite their differences, HCD and CBPR are regarded as complementary approaches for addressing real-world problems and it has been contended that combining these two approaches leads to more effective, scalable, and sustainable solutions (Chen et al., 2020). For example, CBPR's focus on ensuring that community partners have an equal voice in some, or all, aspects of the research may ultimately help to increase the relevance and appropriateness of a particular product or service to end-users (Henderson et al., 2013).

In the first section of this paper, we briefly review the small, but growing, body of literature on HCD+CBPR integration approaches, discuss reliance on in-person engagement strategies, and highlight the challenges associated with in-person formats and implications for the quality of participatory research projects. Next, we briefly introduce digitally-mediated participatory research methods (DMPRMs), discuss projects that have used online tools for implementing participatory research, and draw attention to some of the unique challenges posed by DMPRMs. Finally, we present and discuss our case study.

HCD+CBPR Integration Approaches

All participatory research methods (PRMs), including human-centered design (HCD) strategies and community-based participatory research (CBPR) approaches have traditionally relied on in-person engagement strategies, or "formats that require meeting stakeholders physically and spending time with them" (Köpsel et al., 2021). However, as demonstrated below, obstacles such as logistical issues, security issues, and time pressure have the potential to compromise the quality of in-person PRMs. For example, Henderson et al. (2013) employed a combination of in-person focus groups and high-fidelity

prototypes (working software) for the development of an interactive, tailored, web-based diabetes medication education and decision support—the iDecide/Decido decision aid—using the principles of CBPR and HCD. As evident from the statement below, they encountered the following challenges:

> There were, however, some challenges in our development process. CBPR can require a slower process. Because of the number of stakeholders, varying availabilities, and desire to ensure equality of participation in the research and development process, it took time to gather feedback, reach consensus on changes, and incorporate feedback. Time constraints also made it difficult for the program to be tested by [community health workers] earlier in the timeline... We tried to minimize communication barriers through regular interactions and involvement with team members....(Henderson et al., 2013, p. 9)

Similarly, Kia-Keating et al. (2017) used a combination of in-person meetings (interactive community forums/CBPR) and low-fidelity prototypes (storyboards/HCD) in their efforts to address violence-related health disparities among Latinx youth. Notably, they identified several poverty-related stressors that had the potential to prevent or hinder participation in their community forums. This is evident from the statement below:

> It is critical to identify potential barriers for attendance at community forums, as well as make forums accessible, appealing, and meaningful for potential participants... Each of our community forums included typical Latino/a fare served for lunch or dinner, depending on the time of the forum. Parents could bring children and be assured that their family would be served a meal, and that children's activities were also included during the forum, so that parents did not need to obtain childcare... Raffle prizes donated by local organizations, and bags of groceries provided by the local Food Bank were also provided to participants. Finally, the timing and location of the events were planned with Community Advisory Board (CAB) members, and additional youth advisors, who provided guidance on how to reduce barriers of transportation, and to involve as many different sub-groups within the community as possible.... (Kia-Keating et al., 2017, p. 164)

Furthermore, Fakoya et al. (2022) recently employed a combination of in-person "bootcamps" (short, intensive courses on effective youth-adult partnership) and low-fidelity prototypes (pen and paper) in their efforts to increase modern contraceptive use among 15- to 19-year-old girls in three African countries. However, their attempts to recruit extreme users as project partners were hampered by anonymity, security, logistical concerns, and the political context.

As evident from the above discussion, the methodology of PRM including CBPR presents a variety of challenges for engaging community participants in face-to-face participatory research. Notably, one of the primary drivers for the development of VLL's digital portal was the fact that a significant proportion of Welsh veteran service users and their families live in rural and isolated geographies. While variables such as time investment and transportation constitute major impediments to in-person CBPR with rural dwellers, by moving from a face-to-face to a digitally mediated approach these barriers can be reduced, if not eliminated.

Digitally Mediated Participatory Research Methods for the Development of a Digital Access-to-Justice Platform

There is now a growing interest in how online tools such as email, texting, social media, and videoconferencing can impact PRMs. For instance, Jessell et al. (2016) found that a computer-supported collaborative work (CSCW) technologies platform was an effective tool for building relationships and promoting communication and connections for CAB members (Jessell et al., 2016). Nevertheless, they encountered the following challenges:

> While the use of technology, including iCohere, was useful to the CBPR process in many ways, the challenges experienced by the Newark Community Collaborative Board (NCCB) offer important lessons for future work. Difficulties described by NCCB members in using some of the technology relates to a problem in the CSCW field referred to as the "social-technical gap" [that is the] 'fundamental mismatch between what is required socially and what we can do technically'... In order to use technology successfully, we must understand this gap and how people use technology in their lives and work and how these technologies can best capture the social nuances and contexts of people's lives... Another important consideration when selecting and introducing CSCW technology into the CBPR process is cost. . (Jessell et al., 2016, pp. 251–252)

Furthermore, there is competing literature on the impact of building solidarity when using a digitally mediated approach for CBPR that contests the efficacy of solidarity building through a digital medium. Valdez et al. (2020) found that an online platform expands access to participation by allowing flexible attendance options and eliminating barriers to transportation and childcare. However, they also observed several barriers in moving to an online platform:

> Online-based CBPR removes a sense of solidarity in relationship building that is inherent to attending meetings, chatting over coffee and refreshments, participating in group presentations/

> meetings, and the networking that often follows those meetings. This sense of solidarity is critical to building trust between community members and researchers... (p. 7)

In contrast, Hall et al. (2021) argue that it is possible to build solidarity with online tools, particularly when a pre-existing relationship between academic partners and community partners has already been established. The VLL falls into the latter category, having already established trust with the community partners as part of its ongoing long-term relationship with community partners.

As evident from the below statement, an additional challenge associated with online platforms was the potential lack of privacy and confidentiality stemming from the environmental surroundings of accessing the internet in a home setting or public location:

> The online format may preclude participants' ability to discuss their experiences in a private/confidential setting. Thus, a desirability effect may shape responses based on one's surroundings. For example, one of the emerging youth CAB members visibly appeared hesitant to respond when asked a question about how gender identity and sexual orientation discrimination may influence ASRH [adolescent sexual and reproductive health] outcomes. They were on Zoom at home with siblings and parents around, which may have influenced their response. (Valdez & Gubrium, 2020, p. 7)

This may be a challenge for digitally-mediated CBPR, particularly when researching sensitive topics, but the nature of the VLL's research did not revolve around sensitive topics. Access to digital technology for participants with significant social-technical gaps and fewer electronic resources was a more immediate barrier faced in this research. This was an additional concern identified by both Valdez et al. (2020) and Jessell et al (2016). Within the context of the VLL's research, this access needed to be addressed as the demographics of veterans included a wide range of technical skills and age demographics from service users in their 20s to their 80s. The primary means for managing this barrier was the engagement of our community partners who were able to co-facilitate the digitally-mediated focus group sessions, provide access to the necessary technologies, and bridge the social-technical gap to successfully use the video-conferencing software to enable participation.

The Case: Enhancing DMHCD With DMCBPR Approaches

As far as we are aware, ours is the first study to holistically employ a digitally mediated HCD+CBPR approach. The present study aimed to achieve the following objectives: first, to add to a small but growing body of research around digitally-mediated participatory research methods; and second, to add to the emerging literature on HCD+CBPR integration approaches to design interventions for underserved populations. In our capacity as academic

partners within the Community Advisory Board (CAB) created to manage the project's delivery, we witnessed the negative impact of the COVID-19 pandemic on social engagement. Specifically, the government's social distancing measures made our in-person engagement strategies untenable. These strategies (e.g., face-to-face survey, word-of-mouth recruitment, in-person meetings, and usability testing with low-fidelity prototypes using in-person meetings) were designed to enable us to achieve our ultimate goal—to design an innovative and bespoke digital access to a justice platform for military veterans and their families that not only addressed their access-to-justice needs but was also easy to use. To comply with social distancing measures and mitigate the spread of COVID-19, we had to revisit our engagement strategies and consequently adapted human-centered design (HCD) strategies and community-based participatory research (CBPR) approaches to an online delivery mode (video-conferencing, Facebook recruitment, web-based survey and usability testing with high-fidelity prototypes using video-conferencing software) (see Table 1).

Furthermore, we defined our research focus based on HCD, but the product of the research was developed through CBPR approaches. Thus, community partners in their capacity as CAB members acted as advisors; co-facilitated focus group discussions with veteran service users; lent their support to the grant application; participated in several aspects of the web-based survey process; brainstormed ideas for developing the digital access-to-justice platform and participated in usability testing (see Table 2). Our digitally-mediated HCD+CBPR approach was: 1) identify the user and specify the context of use; 2) specify the user requirements; and 3) produce design solutions (Harte et al., 2017). However, it should be emphasized that our project is still ongoing as we are currently creating design solutions.

The Target End Users and the Context of Use: Community Advisory Board

In 2019, academic partners in our dual roles as researcher and implementer of the Veterans Legal Link project, a collaborative access-to-justice project, carried out an audit to compare the rate of engagement with face-to-face consultations via drop-in clinics versus online consultations. The audit showed that only 30% of veteran clients took up the opportunity for traditional face-to-face consultations via drop-in clinics. So, we came up with the idea of creating a bespoke access-to-justice digital platform and spent time with pre-existing community partners to develop a strategy for understanding veteran users' needs and preferences regarding the features of an access-to-justice digital platform. According to Henderson and colleagues, "[b]uilding on established relationships facilitates research processes and collaborations" (2013). This was evidenced by the fact that the Community Advisory Board (CAB) for the digital access-to-justice platform grew out of the pre-existing collaboration between academic and veteran community partners. Notably, academic partners and community partners had a five-year relationship prior to the start of the project described in this paper. This relationship revolved around the

Table 1. Benefits and challenges of shifting from in-person to virtual/online format

Pre-pandemic plan	Digitally-mediated approaches	Benefits of digitally-mediated approaches	Challenges associated with digitally-mediated approaches
Face-to-face survey	Web-based survey	1. Inclusivity (participation of mainstream and extreme users) 2. Anonymity 3. Wide reach	Anonymity and the difficulty in distinguishing between eligible participants, ineligible participants, and fraudulent participants posed a major challenge.
Building and sustaining relationships via in-person meetings	Building and sustaining relationships via video conferencing	1. No travel costs and increased flexibility in terms of meeting dates and times. 2. Enables easy access to high-quality audio recordings of meetings and interviews.	1. When meeting participants had their video cameras and microphones turned off during meetings, they were less likely to be asked for their opinion or actively included in the meeting. 2. Many participants in the asynchronous, anonymous web-based survey were unwilling to engage with synchronous online focus groups.
Usability testing with high-fidelity prototypes using in-person meetings	Usability testing with high-fidelity prototypes using videoconferencing software	1. No travel costs and increased flexibility in terms of meeting dates and times. 2. Provided a more natural research setting as it is was conducted in the users' own environment (e.g. home or office) instead of a researcher's lab. Thus, incorporates ethnographic data collection principles (i.e. participant observation).	1. When participants shared a computer, it was not always easy to delineate between the feedback of a group and ascertain individual opinion
Face-to-face recruitment	Facebook recruitment and word-of-mouth recruitment/ snowballing	1. Wide reach 2. 24/7 recruitment 3. Targeted ads 4. Much less time-intensive compared to traditional methods of recruitment.	Anonymity and the difficulty in distinguishing between eligible participants, ineligible participants, and fraudulent participants posed a major challenge.

joint delivery of legal and non-legal services to Welsh veterans and their families. Hence, community partners felt committed to sustaining the partnership and working on new projects and it was this factor that led to the development of the spin-off project aimed at creating a digital access-to-justice platform (Jagosh et al., 2015).

Furthermore, the CAB consists of seventeen members, including veteran service providers, academics, veteran liaison officers, and the regional Armed Forces Champion. We used a core skills matrix to ensure that members had complementary skills and knowledge. These fields include law, sociology, computer science, graphic design, information studies, mental health, art, older people's specialist, politics, and information studies to mention but a few. According to Chen et al. (2020), "HCD utilizes *transdisciplinary* teams from a diverse range of fields, including business, engineering, design, and research, and they focus primarily on translational application of their results." However, based on our experiences, ensuring convergence and understanding among transdisciplinary team members can be very challenging. We sought to address this challenge by relying on a disciplinary translator, an academic member who had disciplinary translation skills (Mejía et al., 2020). This enabled us to further embed inclusive and equitable strategies into the collaboration. As originally conceived, CAB members would attend bi-monthly, in-person meetings to inform the development of the digital access-to-justice platform. However, due to the onset of the COVID-19 pandemic

Table 2. Timeline of CBPR

HCD + CBPR	Task	Timeline	Insights and experiences
Research focus defined by academic partners in line with human-centered design.	• Academic partners carried out an audit to compare the rate of engagement with face-to-face consultations via our drop-in clinics versus online consultations and noticed that only 30% of clients took up the opportunity for traditional face-to-face consultations via our drop-in clinics.	February 2019	We set out to investigate this issue further by approaching pre-existing community partners.
Academic partners and veteran service providers collaborated on information gathering.	• 2 x 1 face-face co-facilitated focus group discussions (FGDs) and 3 x 1 co-facilitated FGDs with veteran service users and providers (N=40 participants).	July 2019 - May 2020	The FGDs served a dual purpose: 1. To ensure that the research was relevant, appropriate, and needed for the veterans' community. 2. To initiate the process of gathering information and feedback directly from representative users.
Academic partners and veteran service users and providers collaborated on funding for the spin-off project.	• Developed application for three-year sub-project funding in collaboration • Funding successfully secured.	February 2020 – July 2020	• Veteran service users lent their support to the grant application by physically attending a meeting with the Funder. • The purpose of the funding was to create the access-to-justice digital platform. • The funder included stakeholder engagement as an expected impact of the funded project.
Established Community Advisory Board (CAB).	• Clarified responsibilities of CAB members via email.	April 2020 -September 2020	CAB was composed of key Welsh veteran service providers. We established a partnership model whereby each partner brought some contribution or resources to the partnership.
Moving from an interdisciplinary to a transdisciplinary team.	• Recruitment of first Design Team member (Web Project Manager)	October 2020	The aim was to ensure the translational application of the results of our project.
Sustaining engagement of community stakeholders.	• Holding regular monthly/bi-monthly video conferencing meetings.	October 2020 - Summer 2023	• This helped to ensure that CAB members were engaged in the research process • Regular video conferencing meetings also enabled the design team members to immerse themselves in the project's users' lives.
Involvement of community stakeholders in all aspects of the web-based survey process.	• Defined the purpose of Phase 1 Web-Based Survey (P1WBS) • Developed conceptual P1WBS model • Defined P1WBS survey population • Defined P1WBS survey items • Preparation and translation of P1WBS and social media campaign.	April - July 2021	• We wanted to reach a larger and more diverse sample of veterans and provide an opportunity for as many veterans as possible to contribute their ideas and inputs to the development of the digital access-to-justice platform. • The use of open-ended questions served as an effective way to enable veterans to brainstorm possible solutions.
Moving from an interdisciplinary to a transdisciplinary team	Recruitment of post-doctoral fellow ("Disciplinary Translator").	August 2021	The aim was to ensure the translational application of the results of our project and to support better transdisciplinary outcomes.
Applying an iterative process of gathering information	• P1WBS survey open • Monitor P1WBS • Promote P1WBS via Facebook.	2nd August 2021 to 3rd September	Our aim was to survey a larger sample size.
Moving from an interdisciplinary to a transdisciplinary team	Recruitment of Design Team member (Software Developer).	September 2021	A software developer to turn the outcomes of our collaborative design processes into prototypes, and ultimately a finished product.
Information gathering, member checking and brainstorming	• P1WBS data clean-up (spam removal) • Analysis of P1WBS data	September 2021	• The Design Team and academic partners reviewed the answers to the open-ended questions and used the data to focus on actionable insights so as to drive the prototyping process.

HCD + CBPR	Task	Timeline	Insights and experiences
	• Preliminary feedback of P1WBS results to CAB members and other community members via videoconferencing meetings and emails.		• We encountered several problems with the JISC Online Survey tool (formerly Bristol Online Survey (BOS)). These limitations included the fact that JISC does not prevent a survey from being completed many times on the same computer or from the same IP address. In addition, some participants attempted to misrepresent their eligibility in order to obtain the financial incentive for which they were not eligible.
Implementation	• Conduct Phase 2: Prototyping	November 2021-Spring 2022	• The design team and academic partners are currently conducting iterative usability testing.

and subsequent stay-at-home orders, our project was forced to shift completely online. As part of the adaptation process, we used several information and communication technologies to facilitate communication between CAB members and sustain the CAB. This included emails, video conferencing via Microsoft Teams, phone calls, instant messaging, and SharePoint (Etim & Huynh, 2015). For example, email communications facilitated the creation and circulation of meeting agendas before the meetings took place and enabled important documents to be sent to those who had missed meetings (Shoultz et al., 2006). In addition, we granted CAB members access to team and project documents and tiered that access with varying permissions statuses through SharePoint. In line with previous studies, we found that online tools improved communication, facilitated collaboration, and increased productivity among CAB members. Moreover, because of its synchronicity and superior ability to convey verbal and non-verbal cues in comparison to other media, video conferencing was instrumental in cultivating empathy in members of the design team who had a limited understanding of veterans (Dennis et al., 2008; Hacker et al., 2020).

Specification of User Requirements

Having identified the user and specified the context of use, our next aim was to identify the granular requirements of the access-to-justice digital platform. We sought to achieve this through co-facilitated focus group discussions with veteran service users and providers (N=40 participants) and a web-based survey. Furthermore, in line with CBPR approaches, focus-group participants were recruited by community partners and community partners provided resources such as venues and laptops and co-facilitated two pre-pandemic face-to-face focus groups and three online focus groups with veteran service users and providers (see timeline). We employed an interactive focus group model which notably deviates from conventional focus-group methodology in the following ways. First, participants knew one another; second, there was a reduction in the power differential between moderators and participants because academic partners also contributed their views and experiences to the process of the group (Jenkinson et al., 2019). The fact that focus group participants were asked questions in an interactive setting and were encouraged to discuss their thoughts freely with other participants was instrumental in generating ideas

and provided academic partners with a wealth of information for developing the access-to-justice digital platform. Reflecting on our experiences, important advantages of online video conferencing engagement include the fact that it eliminates travel costs, provides flexibility in terms of meeting dates and times, removes geographic barriers, and replicates in-person interactions.

Furthermore, academic partners used insights provided by the focus group discussions for developing the closed-ended survey questions of a web-survey instrument (Morgan, 1998). Notably, the following themes emerged from the focus group discussions: 1) the ability to send messages to an advisor; 2) being able to access my case and any updates at any time; 2) to be able to upload documents that I need advice on; 4) for my case worker or peer mentor to have access to my case, too; and 5) to be able to request and book advice appointments online. Thus, the closed-ended questions reflected community partners' priorities. Moreover, we added the following "any other comments" questions to the web-survey instrument: "What encourages you to trust a website or mobile app?"; "What other features would you like to see from a free legal advice website or mobile app?"; and "What's your favorite website, and why?" (Decorte et al., 2019; O'Cathain & Thomas, 2004). In so doing, our intentions were twofold. First, we wanted to engage community members (both mainstream users as per CBPR and "extreme users" as per HCD) in idea generation as open-ended questions enable respondents to give more details about issues. Second, in line with the goals of HCD and CBPR and as recommended by Decorte and colleagues (2019) and O'Cathain and Thomas (2004), we wanted to use open-ended questions as a mechanism for shifting power dynamics between researchers and participants.

We presented the draft web survey instrument for approval and validation by community partners (Doyle, 2007). Thereafter, we delivered the survey instrument using the JISC Online Survey tool (formerly Bristol Online Survey (BOS)) with a link to the survey uploaded to Facebook. The survey was open from August 2, 2021, until September 3, 2021. Participants were recruited using a combination of methods including online recruitment via Facebook and LinkedIn and through snowball sampling. This resulted in more than 1,100 responses. In terms of Facebook recruitment, we primarily used paid adverts. These adverts were targeted toward veteran communities using Facebook advertising tools; specifically, those with military interests (Royal Air Force, British Armed Forces, Army, Veterans, Marines, Navy, Parachute Regiment (United Kingdom), Support The British Army). Ads appeared on sidebar ad panels and in the personalized news feed that is the home page for Facebook users. The ads briefly described the study and allowed an individual to click through to the survey website. All direct promotion ads mentioned incentives for participation and were aimed at cultivating ongoing interest and participation in our study and encouraging social sharing of the survey info with friends. We saw a significant increase in activity on the Veterans Legal Link Facebook page and an increase in inquiries through our website. In addition, we issued five formal reminders during the surveys period, in line

with the periodicity of follow-up mailings noted by Sánchez-Fernández and colleagues (2012). All data was collected and stored anonymously via the Jisc Online Survey tool. No individuals were identified in this research study and participatory consent was implied by completion and submission of the survey.

However, we acknowledge several limitations imposed by the necessary use of the online platform for the delivery of the survey. Some participants attempted to misrepresent their eligibility in order to obtain the financial incentive (an Amazon gift voucher) for which they were not eligible. The Jisc Online Survey tool did not prevent a survey from being completed many times on the same computer or from the same IP address; there was not a control measure such as captcha to minimize this problem (Pozzar et al., 2020). As a result, the team needed to devise a means for excluding the misrepresented survey entries. This was done by assigning each survey response with a likely "spam score" that included aspects such as similarity of responses, the time taken to complete the survey (against the time expected time needed to complete the survey), duplicated responses, and language of response (eliminating any non-English responses). The responses that were included for analysis were those that were assigned a spam score of <20 (out of 100, with 0 being definitely genuine and 100 being definitely spam response). From the perspective of HCD, the exclusion of misrepresented survey entries was essential to ensuring more accurate user requirements.

Producing Design Solutions

We transferred the survey responses from a Microsoft Excel file into the NVivo qualitative software program. Notably, this process was efficient and time-saving as it enabled academic partners to analyze the more than 1,100 responses within a relatively short time span. The data was analyzed by two academic members using the six steps for conducting thematic analysis proposed by Braun and Clarke (2006). Ten main themes emerged from the data which drove the prototyping process: 1) Legal Information and Knowledge Repository; 2) Accessibility; 3) Case management, 4) Clear Description of Veterans Legal Link and Services Provided; 5) Synchronous communication; 6) Asynchronous communication; 7) Directory of Services; 8) Request Preferred Mode of Interaction; 9) Confidentiality statements on App; and 10) Help and Guides. In line with CBPR approaches, prototyping occurred in a cyclical fashion, incorporating elements of co-learning and building on the strengths and resources of all partners. Academic partners and members of the design team co-facilitated two workshop sessions dedicated to prototyping and user testing. These workshops were conducted using synchronous remote usability testing. Specifically, we used the Microsoft Teams screen share functionality to share our designs and elicit feedback from participants. Participants were dynamically presented with the following categories of software-based simulations of user interface elements: input controls such as checkboxes, dropdown lists, list boxes, buttons, text fields and date fields, and informational components such as message boxes and progress bar (U.S. General Services Administration, n.d.).

Reflecting on our experiences, important advantages of remote usability testing include the fact it eliminates barriers such as scheduling issues and travel costs and ensures compliance with software and security requirements. Furthermore, in order to ensure that participants were comfortable with the sessions, we used email communications to provide details of the structure of the session and insights on what to expect. This ensured that when participants arrived, they had a clear idea of the session's objectives and their role, thereby increasing their comfort levels in terms of participation. In addition, videoconferencing enabled academic partners and members of the design team to observe the facial expressions and body language of participants. As we continue into the next phases of the project (user acceptance testing and release of the actual digital access-to-justice platform) we will iteratively conduct synchronous remote usability testing until we are satisfied with the final product.

Discussion

The purpose of this article was to present a case study of a digitally-mediated Human-Centered Design (DMHCD) process enhanced by digitally-mediated community-based participatory research approaches (DMCBPR) as part of our efforts to develop a digital access-to-justice platform for military veterans and their families. We reflect on our experience of enhancing DMHCD with DMCBPR. The process of developing the platform revealed some interesting insights regarding the mutually-reinforcing benefits of HCD and CBPR. This revelation—even in a digitally mediated form—demonstrated that there were benefits to combining these approaches and, with the ever-increasing emphasis on digital technology as a result of COVID-19, adds to a growing body of literature on DMPRMs.

CBPR is focused on generating local data that inform local problems and in doing so develops shared trust to further the goals of the community partners by engaging and collaborating with all the stakeholders and partners. This approach has generally been used by academics as part of university-community research partnerships and tends to move at a relatively slow pace. HCD, on the other hand, has historically been used by private sector actors to rapidly define, develop, and create widely usable and useful products and services by putting users at the center of product design and development. This process tends to absent the engendering of trust and a longer-term vision because of the commercial orientation of the process to develop a tangible saleable product.

The combination and nesting of HCD within a CBPR research initiative to provide access for justice for veterans in Wales was mutually reinforcing. Through the CBPR research, the VLL was able to identify a need for a digital platform and start the development of the access-to-justice digital platform project described in this paper. One of the primary aspects of the CBPR revolved around the relationship between academic and community partners' joint delivery of legal and non-legal services to Welsh veterans and their families. The development of a tangible product to enable veterans and their families

to access justice using an HCD methodology engendered trust towards the community's goals of the provision of services needed for Welsh veterans and their families. Through having a pre-existing relationship with the community and already building trust and solidarity with the motivation for the research, CBPR allowed HCD to come to the forefront. As a result, community partners involved in the development of the digital platform were able to freely voice and articulate their own needs, and to provide their personal expertise in their lived experience.

In addition to the combination of HCD with CBPR, the project also had a digitally-mediated component that was an important addition to the discussion. The ongoing development of the digital platform for veterans has demonstrated that the combination of HCD with CBPR can be mutually reinforcing in achieving research goals. The recent change in the context, the pandemic environment, and the need for a transition to a digitally-mediated approach about a year into the development of the project resulted in a change in methodology; while there is a growing body of literature on the impact of a heavier reliance on digital communication (from "Zoom fatigue" (Fosslien & Duffy, 2020) to feelings of discomfort with video calling (Castelli & Sarvary, 2021; Wiederhold, 2020)) we did not observe this in the course of our research and these phenomena were not to the detriment of the project in our specific case.

The challenges with the shift from in-person to a virtual format for the research are detailed in [Table 1](#). While there are several sources that suggest implementing community-based research can be inhibited by conducting it via a digital format, our experience aligns more closely with Dube (2020), who suggests that participatory research can be effectively conducted solely from a distance. For the VLL, this was helped by the long-standing relationship with the Welsh veterans' community, which has been built over the course of the last five years, and the shared continuous engagement and collaboration by all partners. However, we did face some specific HCD-related challenges regarding social media recruitment for participants in the research. We did not see these challenges represented in the existing literature. For conducting social media research in the future, we intend to follow the suggestions by Kramer et al. (2014) for strategies to address participant misrepresentation for eligibility in web-based research. We hope our experience will aid other researchers requiring a shift to a digitally-mediated research format in the future.

Overall, our conclusion and the experience of the method undertaken in the development of the online access-to-justice platform described in the paper supports Chen et al.'s (2020) assertion that the combination of CBPR and HDC approaches leads to more effective, scalable, and sustainable solutions. These positive results were still maintained despite the need to transition from an in-person to a digital format for conducting the research.

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