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Distributed Autonomous Organization of Learning: Future Structure for Health Professions Education Institutions

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Abstract

Current health professions education (HPE) institutions are based on an assembly-line hierarchical structure. The last decade has witnessed the advent of sophisticated networks allowing the exchange of information and educational assets. Blockchain provides an ideal data management framework that can support high-order applications such as learning systems and credentialing in an open and a distributed fashion. These system management characteristics enable the creation of a distributed autonomous organization of learning (DAOL). This new type of organization allows for the creation of decentralized adaptive competency curricula, simplification of credentialing and certification, leveling of information asymmetry among educational market stakeholders, assuring alignment with societal priorities, and supporting equity and transparency.

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KEYWORDS

blockchain; multidisciplinary; credentialing; medical education; health professionals; education; decentralization; training; curriculum; instruction

Health professions education (HPE) institutions are hierarchical structures designed to educate and train professionals using a model of education that is chronologically sequential and geographically restricted, and resembles an assembly line. Concurrent licensure, certification, and credentialing systems are also structured in the same rigid manner [1].

The past decade has witnessed the emergence of the knowledge economy, arising from a model appropriate for the manufacturing industry and evolving toward forming information-rich, adaptive, solution-oriented, network-based systems. This new tenet is based on the paradigms of open, distributed, decentralized, and scale-free networks [2].

The advent of complex network information systems and scalable data platforms has transformed information exchange and enabled the development of sophisticated networks, where goods, financial instruments, data, and information are handled. These scaffolds also support social media and learning networks [3]. Unfortunately, HPE organizations have neither developed nor embraced these new models.

One of the fundamental technologies powering modern information exchange networks is blockchain, which can be simply described as an open market of information where the origin and flow of assets can be traced openly, securely, and trustworthily [3].
Blockchain can potentially provide a framework to support network-based knowledge management in HPE by allowing the creation, sharing, and usage of data that are distributed and stored simultaneously in warehouses open to all users. The inception, modification, and derivation of these data are possible for all members of the system, as all modifications to the system are clearly time stamped; authors are identified, and information is secured by advanced encryption. This creates a type of information that is reliable, traceable, and valid, with the ability to propagate rapidly and securely through communities of users [3]. Although blockchain appears ideal for information management, it is its ability to serve as the foundation of higher-order applications that is of paramount importance.

These blockchain-based systems enable the potential creation of the distributed autonomous organization of learning (DAOL) [4]. The DAOL constitutes a digital space where assets are negotiated autonomously and trustworthy. The DAOL can be conceptualized as a knowledge market, where goods (or digital assets such as a skill or credential) are interchanged when certain conditions are met (eg, course credit when an assessment threshold is achieved). These transactions occur automatically after prespecified conditions are met without human intermediaries or a central authority. The exchange of assets takes place using smart contracts, agreed upon by the participants of the organization before market transactions start. The contract execution is guaranteed by autonomous agents, which are algorithms that act as a digital notary for the market.

A DAOL for HPE would create a cascade of possibilities for curriculum development, licensing, certification, credentialing, and clinical practice.

First, the creation of DAOL systems will unbind disciplines (medicine, nursing, etc), institutions, locations, and time zones. Curricula will consist of a mesh of instructional modalities and microcredentialing badges creating a conceptual change from a cohorted, time-defined progression through a curricular path, leading to a progression that is nonlinear and not defined by time or location. HPE learners would be able to create adaptive learning objectives and curricula reflecting the specific knowledge and skills required for a particular job description rather than a general discipline (eg, emergency perfusionist instead of cardiac anesthesiologist specialized in extracorporeal oxygenation). This paradigm shift will likely lead to a pivot from the primacy of professional identity to a primacy of professional competency.

Second, the DAOL will allow the completion of these curricula in an automated manner once the learner has complied with the previously specified conditions (ie, smart contracts). These contracts will likely resemble entrustable professional activities mirroring clearly defined clinically based competencies. Governance of the system will rest on autonomous agents and not on human administrators or registrars, allowing faculty to focus on role modeling, coaching, assessment, and teaching clinical skills. Credentialing and licensing can be simplified, automatized, and made significantly less expensive. A DAOL system would make all necessary information open to all users; there will be no information asymmetry among players in the market.

Third, the DAOL creates a forum, through decentralized applications, for all stakeholders to participate in the design of the system. Patients, health care workers, government agencies, universities, and prospective employers would help elaborate curricula that are contextually relevant, continuously updated, and fit for purpose on communities. Existing reusable learning objects will be automatically validated, and where required, they could be created, adapted, and validated by others. At the same time, contractual conditions and requirements can be made explicit and automated, allowing for a job market that is more efficient, transparent, and equitable. This could create a learning system that reflects the diverse needs of societies throughout the world.

We believe that the DAOL constitutes a new educational exchange structure that supports the construction and validation of knowledge, and the creation of a modern learning management system. This framework allows for a new paradigm for HPE that is distributed, open, and valid, with profound implications for curriculum development, licensing, certification, credentialing, contracts, and clinical practice. The DAOL might be the answer to the calls for reimagining the future structure of HPE.

Conflicts of Interest
None declared.

References
Abbreviations

DAOL: distributed autonomous organization of learning
HPE: health professions education
Comparing Web-Based and In-Person Educational Workshops for Canadian Occupational Therapists and Understanding Their Learning Experiences: Mixed Methods Study

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Abstract

Background: The Do-Live-Well (DLW) framework is an occupation-focused health promotion approach. Occupational therapists (OTs) have been interested in training opportunities regarding this framework. Traditionally, in-person continuing educational interventions are the main way that OTs obtain knowledge, but web-based learning has become popular among health care professionals. However, its effectiveness and learners’ experience in web-based learning have not been well-studied in occupational therapy education.

Objective: This study aims to evaluate the effectiveness of the web-based and in-person educational DLW workshops for Canadian OTs and to understand their experiences in both workshop types.

Methods: An explanatory sequential mixed methods study design was used, where quantitative data were collected first, then qualitative data were used to explain the quantitative findings. A quasi-experimental design and interpretative description methodology were used in the quantitative and qualitative phases, respectively.

Results: Quantitative results were as follows: a total of 43 OTs completed pre-, post-, and follow-up evaluations (in-person group: 21/43, 49%; web-based group: 22/43, 51%). Practice settings of the participants varied, including geriatric, hospital, long-term, mental health, pediatric, and primary settings. The primary outcome was as follows: there were no statistically significant differences in knowledge changes at the 3 time points (P=.57 to P=.99) between the groups. In the web-based group, the knowledge scores at follow-up were lower compared with the posttest results, meaning that knowledge gain was reduced over time (P=.001). The secondary outcomes were as follows: there were statistically significant differences between the groups in factors influencing DLW adoption at posttest (P=.001) and in satisfaction with the workshop (P<.001) at posttest in favor of the in-person group. Qualitative results were as follows: a total of 18 OTs (9/18, 50% from each group) participated in an individual interview. Five themes were identified regarding learners’ workshop experiences: relevance to their practices and interests may improve learning, a familiar learning environment may facilitate learning, synchronous in-person interaction is valuable in the learning process, ease of access to learning should be considered, and flexibility in web-based learning can be both beneficial and challenging.

Conclusions: The quantitative results of this study reported no difference in knowledge acquisition between the in-person and web-based groups, indicating that web-based education is as effective as in-person workshops. However, participants’ satisfaction with the workshop was statistically significantly higher for the in-person workshop. The qualitative findings described the participants’ perceived benefits and challenges of each educational format. The participants in both the web-based and in-person workshop groups valued in-person interactions in learning, but the participants in the web-based workshop group expressed web-based learning lacked in-person-like interactions. Thus, adding synchronous in-person interactions to web-based learning may improve learners’ educational experiences in web-based occupational therapy and continuing education.
Introduction

Background

Each day, human beings engage in various occupations, defined as sets of activities for purposes, such as self-care, leisure, and productivity that are a core concept of occupational therapy [1]. Occupational-focused frameworks are used by occupational therapists (OTs) to understand occupational issues, enabling the provision of services that are responsive to the needs and goals of the clients [2]. The Do-Live-Well (DLW) framework is an evidence-based Canadian health promotion approach developed by OTs [3]. The key message of the DLW framework is that engaging in daily patterns of activity that allow for an optimal range of experiences with sufficient personal and social support can lead to a wide range of positive health and well-being outcomes [3]. Despite interest in this relatively new framework from OTs around the world, continuing education to support the adoption of the framework in practice has been limited to only certain areas of Canada, including Quebec and Ontario. On the basis of requests nationally and internationally, the developers of the framework identified a need to provide educational opportunities to meet these expanding learning needs.

The importance of health care professionals engaging in continuing education activities to advance their professional knowledge and expertise has long been emphasized [4]. OTs have used continuing education as a primary resource to maintain and improve their knowledge, ensure clinical competency, and pursue personal and professional development [5,6]. The importance of continuing education in occupational therapy practice has been addressed in literature [7-9]. Although the most common type of continuing education for OTs is through in-person delivery methods such as conferences, presentations, and seminars or workshops [6], web-based education has become increasingly popular in health care professions across the world [4].

In this study, the term web-based learning was defined as “learning experiences via the use of some technology” [10]. Although cultural and technological adaptations are required to implement web-based learning [11,12], the advantages of this web-based delivery modality have been shown in health professional education, such as easy accessibility to learning without geographical restrictions, customized learning pace, and multimedia use [11-14]. In particular, the COVID-19 outbreak in December 2019, leading to public health restrictions through 2020 and 2021, has dramatically changed the means of delivering knowledge from traditional in-person learning to web-based methods [15]. This indicates that web-based learning is no longer simply an option but rather an essential educational delivery route. Although the importance and availability of web-based education in occupational therapy has been emerging since the beginning of the 21st century [16], the effectiveness of web-based education as a continuing educational opportunity compared with in-person education for OTs has not been well-studied. A systematic review comparing the effectiveness of web-based and traditional in-person learning reported little or no difference in the knowledge, behavioral changes, or skills of health professionals [17]. However, these results may not be definitively generalized to occupational therapy education because only a small proportion of study participants were OTs (only 8% to 11% of OTs in one randomized controlled trial) [17]. Furthermore, although the existing studies provide quantitative results in terms of the effectiveness of web-based and in-person learning, they lack an understanding of how the participants experienced these educational delivery methods. This understanding of what does or does not work well in both educational methods may help educators in occupational therapy improve future learning environments. Thus, research is needed to compare the effectiveness of web-based and in-person education delivery methods and to understand the learning experiences of the participants in continuing occupational therapy education.

Objectives

The objective of this study is to compare the effectiveness of a web-based DLW workshop with an in-person model for Canadian OTs and to understand the learners’ experience of participating in both web-based and in-person workshops. The primary research questions of this study are as follows: What is the effectiveness of the web-based DLW workshop compared with the in-person DLW workshop? and What are the perceived benefits and challenges of participating in both educational delivery methods?

Methods

Study Design

Overview

This study was approved by the Hamilton Integrated Research Ethics Board (Project 4114). An explanatory sequential mixed methods study design was used to evaluate the effectiveness of web-based and in-person DLW workshops and to understand the experiences of the participants in learning about the framework [18]. This study consisted of 2 phases, in which quantitative data were collected first and then qualitative data were used to expand on the findings from the quantitative data. A visual diagram of the study process is presented in Figure 1.
Figure 1. Overview of the study design, including the research process, description, and outcome for each stage.

<table>
<thead>
<tr>
<th>Research process</th>
<th>Description</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recruitment</td>
<td>Distributing a workshop flyer via occupational therapist network</td>
<td>N = 50 (in-person, n=21; web-based, n=29)</td>
</tr>
<tr>
<td>Quantitative data collection</td>
<td>Pre-, post-, and follow-up evaluations</td>
<td>Pretest N = 50 (in-person, n=21; web-based, n = 29)</td>
</tr>
<tr>
<td>Quantitative data analysis</td>
<td>t test, chi-squared test, Fisher’s exact test, Mann-Whitney test, robust regression, and 2-way repeated-measures analysis of variance using Stata 14</td>
<td>Post- and follow-up tests N = 43 (in-person, n=21; web-based, n=22)</td>
</tr>
<tr>
<td>Interview guideline development and recruitment of interviewees</td>
<td>Developing interview questions and prompts using maximal variation purposeful sampling</td>
<td>Codes and themes</td>
</tr>
<tr>
<td>Qualitative data collection</td>
<td>Semistructured interviews</td>
<td>Interview transcripts</td>
</tr>
<tr>
<td>Qualitative data analysis</td>
<td>6-step thematic analysis and interpreting the data</td>
<td>Codes and themes</td>
</tr>
<tr>
<td>Integration of the quantitative and qualitative data</td>
<td>Interpretations and explanation of the quantitative and qualitative findings and interpreting the data</td>
<td>Discussion</td>
</tr>
</tbody>
</table>

**Quantitative Phase**

A pre-, post-, and follow-up quasi-experimental design was used to compare the immediate and subsequent outcomes of the web-based workshop with those of the in-person workshop. Participants were not randomly assigned because of geographical limitations.

**Qualitative Phase**

An interpretative description approach [19] was used to understand the learners’ perceived benefits and challenges of participating in the workshops. Interpretative description was considered appropriate for use because it allows for a flexible approach to capturing the experiences of the participants and for researchers to apply research findings to practice [19].
Participants

Quantitative Phase
Participants were Canadian OTs who were offered to attend either the web-based or in-person DLW workshop, and they selected one of the learning formats to attend. We recruited participants by distributing a research flyer via Canadian OT communities and offered the workshop free of charge as part of the study participation. Canadian OTs practicing in any setting were eligible to participate in this study because the DLW framework is designed to be applied to people of any age, health condition, capacities, and occupational challenges. The total target sample size was 51; this estimate was based on an expected effect size of 0.9 gain in knowledge [20], where a power of 0.8, α of .05, and a 20% dropout rate were applied. A workshop flyer was posted on the Canadian Association of Occupational Therapists website, and the DLW team members shared the flyer with colleagues in their network to recruit eligible participants.

Qualitative Phase
Although there are no guidelines for calculating sample size in qualitative research [21], and interpretative description can be performed with almost any sample size [19], it is recommended to have at least 12 participants to reach data saturation in this type of design [22]. We recruited web-based and in-person workshop participants for a semistructured, 1:1 interview. We sent an invitation to all workshop participants via email to seek participation in an interview 3 months after the workshop. We hoped that we would gain various perspectives from participants in different clinical settings who used the DLW framework to varying degrees regardless of their education, work experience, and gender [23].

Textbox 1. Workshop schedule.

<table>
<thead>
<tr>
<th>Workshop schedule</th>
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<tbody>
<tr>
<td>Introducing instructors, participants, and learning and teaching approach</td>
</tr>
<tr>
<td>• Session 1</td>
</tr>
<tr>
<td>• Introducing case scenarios</td>
</tr>
<tr>
<td>• Health promotion and health and well-being outcomes</td>
</tr>
<tr>
<td>• Session 2</td>
</tr>
<tr>
<td>• Introduction of the Do-Live-Well framework</td>
</tr>
<tr>
<td>• Dimensions of activity</td>
</tr>
<tr>
<td>• Session 3</td>
</tr>
<tr>
<td>• Activity patterns</td>
</tr>
<tr>
<td>• Social and personal support</td>
</tr>
<tr>
<td>• Session 4</td>
</tr>
<tr>
<td>• Application of the Do-Live-Well framework</td>
</tr>
<tr>
<td>• Large group case scenario discussions</td>
</tr>
<tr>
<td>• Wrapping up</td>
</tr>
<tr>
<td>• Question and answer and reflection</td>
</tr>
<tr>
<td>• Postevaluation</td>
</tr>
</tbody>
</table>
Data Collection

Quantitative Phase

We developed the pre- (Multimedia Appendix 1), post- (Multimedia Appendix 2), and follow-up (Multimedia Appendix 3) questionnaires specifically for this study through a literature review and consultation with 4 occupational therapy research experts from the DLW research team. The purpose of the consultation was to ensure that the appropriate questions were included to measure the workshop outcomes. Three levels of the training evaluation model by Kirkpatrick and Kirkpatrick, including reaction, learning, and behavior, were used to decide on the content of the questionnaires [25]. The questionnaires at each time point consisted of slightly different content packages (Textbox 2) but aimed to capture a comprehensive understanding of the effectiveness of the workshop. We incorporated the key constructs of the diffusion of innovation model [26] into the questionnaire, particularly for questions about factors influencing DLW adoption. This was intended to ensure a comprehensive evaluation of the appropriate parameters to determine the potential for adopting the DLW framework among OTs. The diffusion of innovation model explains how new knowledge (innovation) is disseminated in a certain social system over time, and the main constructs used are attributes of innovation, communication channels, and the social system [26]. After developing the initial versions of the questionnaires, the researchers pretested them qualitatively with 4 graduate students in the rehabilitation science program at McMaster University. The questionnaires were refined based on the feedback from the students and discussions with the DLW research team members. For example, the level of knowledge questions was adjusted, and more detailed instructions were added.

Textbox 2. Questionnaire content.

<table>
<thead>
<tr>
<th>Pretest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 1: background information about the participant</td>
</tr>
<tr>
<td>Part 2: current status of the use of the Do-Live-Well (DLW) framework</td>
</tr>
<tr>
<td>Part 3: factors influencing DLW adoption</td>
</tr>
<tr>
<td>Part 4: knowledge questions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 1: factors influencing DLW adoption</td>
</tr>
<tr>
<td>Part 2: knowledge questions</td>
</tr>
<tr>
<td>Part 3: satisfaction with the workshop</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Follow-up test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 1: current status of the use of the DLW framework</td>
</tr>
<tr>
<td>Part 2: factors influencing DLW adoption</td>
</tr>
<tr>
<td>Part 3: knowledge questions</td>
</tr>
</tbody>
</table>

Primary Outcome

The primary outcome was knowledge of the DLW framework. The DLW research team tested how much the participants knew about the DLW framework at 3 time points (pre-, post-, and 3-month follow-up) through 2 multiple-choice questions and 8 true-or-false questions. Each question had a value of 1 point for a correct answer; if a respondent answered all questions correctly, they earned 10 points. The participants were asked to complete the preworkshop questionnaire 1 week before the workshop to evaluate their baseline level of knowledge of the DLW framework. The participants then were required to complete the postworkshop questionnaire immediately following the workshop, and 3 months after the workshop the participants were asked to complete the follow-up questionnaire.

Secondary Outcomes

The secondary outcomes included the following: (1) changes in factors influencing DLW adoption, (2) satisfaction with the workshops, and (3) current use of the DLW framework. For factors influencing DLW adoption, the questions asked were about the advantages, compatibility, complexity, trialability, and observability of DLW use [26]. The participants also evaluated their communication channels, social system, and intentions for DLW use. All participants were asked to complete their evaluations at 3 time points (pre, post, and 3-month follow-up). The questionnaire included 10 questions, a 6-level Likert scale (1=strongly disagree to 6=strongly agree), and the total score ranged from 10 to 60. The core ideas of the questionnaire were the same for the pre-, post-, and follow-up questionnaires, with the exception of 1 question regarding the participants’ desire to apply the DLW framework that was removed for the follow-up test. The participants were asked to score their satisfaction with their workshop experience immediately after the workshop. The satisfaction questionnaire consisted of 16 questions, with a Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), and its total score ranged from 16 to 112. The following are some of the example questions that were included: the accessibility of the workshop was convenient, the learning environment encouraged me to actively participate in learning, and the time frame of the
workshop was appropriate. Finally, the participants were asked about their current use of the DLW framework by answering a yes or no question in both the pretest and follow-up questionnaires. They were also asked about the frequency with which they had used the DLW framework with their clients and at an organizational level, where 0 indicated never use it and 10 indicated use it all the time.

Qualitative Phase
The first author (SK) developed the qualitative interview guide based on the findings from the follow-up quantitative data analysis. The goal of this qualitative phase was to understand what worked well and what did not work well for participants in both learning formats by acquiring a comprehensive understanding of the participants' learning experiences. The interview questions focused on exploring the experiences of each participant in the workshop, including facilitators and challenges of participating in the workshop and engaging with the workshop content, as well as recommendations for future workshops. Each interview lasted 40-60 minutes. Owing to the COVID-19 pandemic, all participants were interviewed on the web using the videoconferencing platform Zoom. The interviews were audio- and video-recorded with the consent of the participants.

Data Analysis
Quantitative Phase
All statistical analyses were conducted using Stata version 14 (StataCorp) [27]. Descriptive statistics were generated to present the characteristics of the participants and the variables of interest. The 2-tailed t test was used to find the differences in the mean total scores of the normally distributed variables between the 2 groups. If the variable was not normally distributed, the Wilcoxon-Mann-Whitney test was conducted. To find differences in categorical variables between the 2 groups, the chi-square test was used, and the Fisher exact test was applied in the analysis of small samples. Robust regression was conducted as an alternative to the analysis of covariate and linear regression because of the violation of normality and homogeneity of variance assumptions, respectively. Any statistically significant differences over time in the variables was found using 2-way repeated-measures analysis of variance.

Qualitative Phase
The interviews were transcribed verbatim by the first author (SK), and data analyses were supported using NVivo 12 (QSR International) [28]. We followed the 6-step analytical process described by Braun and Clarke [29]. This process included the following: familiarizing with the data through repeated readings, developing codes, grouping codes into themes, reviewing themes, generating definitions and names of the themes, and writing a report [29]. The first author read all transcripts several times and immersed herself in the data. Then, she generated initial codes relevant to the primary goal of the qualitative phase, which was to understand the benefits and challenges of participating in a web-based or in-person workshop. When generating the themes, the researchers realized that participants in both groups had some experience with both formats, although not in the DLW workshop. For example, participants in the web-based group had prior experience with in-person learning and shared various perspectives on the benefits and challenges of participating in both formats. Thus, rather than generating themes comparing the experiences of participants in the web-based and in-person workshop, we generated themes describing the comprehensive perspectives and experiences of the participants regarding both formats. The first author then presented the data analysis process and reported the initial themes to the research team. The themes were refined and finalized through discussions among the research team.

To establish the credibility of the findings, the first author wrote reflective notes for each interview participant and discussed with the research team whether the identified themes answered the research questions [30]. Furthermore, detailed descriptions of the research methods were provided to ensure the dependability of the qualitative findings [30].

Results
Quantitative Data: Participant Characteristics
Initially, 50 OTs agreed to participate in the study (in-person group: 21/50, 42%; web-based group: 29/50, 58%). In total, 6 participants did not complete both the post- and follow-up evaluations. One participant did not complete the postevaluation, and another participant did not complete the follow-up evaluation. Because all evaluations were performed anonymously, it was impossible to personally contact those who did not complete the post- and follow-up evaluations to ask them why they did not complete the evaluations. Although we sent multiple emails to remind the participants of the evaluations, no one sent an email stating that they could not complete the evaluations. Thus, data comparing 21 in-person and 22 web-based workshop participants have been presented. There was no statistically significant difference in demographic characteristics between the 2 groups. The detailed characteristics of the participants are presented in Table 1.
Table 1. Participant characteristics.

<table>
<thead>
<tr>
<th>Variables</th>
<th>In-person (n=21)</th>
<th>Web-based</th>
<th>Total</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean (SD)</td>
<td>39.29 (11.1)</td>
<td>38.3 (9.70)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>38.79 (10.32)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.86</td>
</tr>
<tr>
<td><strong>Sex</strong> n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>21 (100)</td>
<td>22 (100)</td>
<td>43 (100)</td>
<td>.99</td>
</tr>
<tr>
<td>Male</td>
<td>0 (0)</td>
<td>1 (5)</td>
<td>1 (2)</td>
<td></td>
</tr>
<tr>
<td><strong>Education level</strong> n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BScOT&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4 (19)</td>
<td>7 (24)</td>
<td>11 (22)</td>
<td></td>
</tr>
<tr>
<td>MScOT&lt;sup&gt;d&lt;/sup&gt;</td>
<td>17 (81)</td>
<td>22 (76)</td>
<td>39 (78)</td>
<td></td>
</tr>
<tr>
<td><strong>Overall years of experience as an occupational therapist, mean (SD)</strong></td>
<td>13 (11.73)</td>
<td>12.46 (8.64)</td>
<td>12.69 (9.94)</td>
<td>.80</td>
</tr>
<tr>
<td>Years of practice in the current setting, mean (SD)</td>
<td>8.28 (9.89)</td>
<td>6.26 (6.33)</td>
<td>7.11 (7.99)</td>
<td>.64</td>
</tr>
<tr>
<td><strong>Resources used to learn about DLW&lt;sup&gt;e&lt;/sup&gt; before the workshop</strong> n (%)</td>
<td>21 (100)</td>
<td>29 (100)</td>
<td>50 (100)</td>
<td>.05</td>
</tr>
<tr>
<td>Journal</td>
<td>0 (0)</td>
<td>1 (3)</td>
<td>1 (2)</td>
<td></td>
</tr>
<tr>
<td>Lecture</td>
<td>1 (5)</td>
<td>2 (7)</td>
<td>3 (6)</td>
<td></td>
</tr>
<tr>
<td>Website</td>
<td>8 (38)</td>
<td>8 (28)</td>
<td>16 (32)</td>
<td></td>
</tr>
<tr>
<td>&gt;1 of the above</td>
<td>6 (29)</td>
<td>2 (7)</td>
<td>8 (16)</td>
<td></td>
</tr>
<tr>
<td>None of the above</td>
<td>6 (29)</td>
<td>15 (52)</td>
<td>21 (42)</td>
<td></td>
</tr>
<tr>
<td><strong>Practice setting</strong> n (%)</td>
<td></td>
<td></td>
<td></td>
<td>.46</td>
</tr>
<tr>
<td>Geriatric</td>
<td>1 (5)</td>
<td>3 (10)</td>
<td>4 (8)</td>
<td></td>
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<tr>
<td>Hospital</td>
<td>1 (5)</td>
<td>3 (10)</td>
<td>4 (8)</td>
<td></td>
</tr>
<tr>
<td>Long-term</td>
<td>1 (5)</td>
<td>1 (3)</td>
<td>2 (4)</td>
<td></td>
</tr>
<tr>
<td>Mental</td>
<td>10 (48)</td>
<td>8 (28)</td>
<td>18 (36)</td>
<td></td>
</tr>
<tr>
<td>Pediatric</td>
<td>1 (5)</td>
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<td>3 (6)</td>
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<td>Primary</td>
<td>3 (14)</td>
<td>3 (10)</td>
<td>6 (12)</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>1 (5)</td>
<td>0 (0)</td>
<td>1 (2)</td>
<td></td>
</tr>
<tr>
<td>None of the above</td>
<td>2 (10)</td>
<td>9 (31)</td>
<td>11 (22)</td>
<td></td>
</tr>
<tr>
<td><strong>Preference</strong> n (%)</td>
<td></td>
<td></td>
<td></td>
<td>.65</td>
</tr>
<tr>
<td>In-person</td>
<td>21 (100)</td>
<td>29 (100)</td>
<td>50 (100)</td>
<td></td>
</tr>
<tr>
<td>Web-based</td>
<td>17 (80)</td>
<td>20 (69)</td>
<td>37 (74)</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>2 (10)</td>
<td>3 (10)</td>
<td>5 (10)</td>
<td></td>
</tr>
<tr>
<td><strong>Use of the DLW in practice</strong> n (%)</td>
<td>21 (100)</td>
<td>29 (100)</td>
<td>50 (100)</td>
<td>.17</td>
</tr>
<tr>
<td>Yes</td>
<td>2 (10)</td>
<td>0 (0)</td>
<td>2 (4)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>19 (90)</td>
<td>29 (100)</td>
<td>48 (96)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>n=22.  
<sup>b</sup>N=43.  
<sup>c</sup>BScOT: Bachelor of Science in Occupational Therapy.  
<sup>d</sup>MScOT: Master of Science in Occupational Therapy.  
<sup>e</sup>DLW: Do-Live-Well.

Quantitative Data: Primary Outcome

Effects of the Workshops on Knowledge Regarding the DLW Framework

At baseline, the in-person group (n=21) reported a mean of 5.48 (SD 1.75) out of 10 on their knowledge of the DLW framework, whereas the web-based group (n=29) reported a mean of 5.39 (SD 1.69) out of 10, meaning the participants knew approximately half of the core concepts of the DLW framework that were tested in the knowledge questionnaire. The *t* test showed no statistically significant difference between the groups at baseline (*P*=.87).

Immediately following the workshop, the participants who attended the in-person workshop reported a mean of 7.62 (SD
0.22) of 10, whereas the participants in the web-based workshop reported a mean of 7.81 (SD 0.27) of 10. There was no statistically significant difference in knowledge regarding the DLW framework between the 2 groups immediately following the workshop (P=.57).

Similarly, at the follow-up evaluation, there was no statistically significant difference in knowledge regarding the DLW framework between the groups (P=.99). The in-person group reported a mean of 7.05 (SD 1.12) of 10 and the web-based group had a mean of 6.77 (SD 1.80) of 10.

Regarding the knowledge differences over time between the web-based and in-person workshops, the Mauchly test of sphericity validated the use of the 2-way repeated-measures analysis of variance (P=.63). There was no statistically significant interaction between the type of workshop and time regarding knowledge of the DLW framework (F2,48=0.90; P=.41). The main effect for the workshop type was not statistically significant (F1,48=0.15; P=.70), meaning that there was no difference in knowledge means between the in-person and web-based groups over time. In contrast, there was a significant main effect for time (F2,48=40; P<.001). The pairwise comparisons indicated that, in the in-person group, the knowledge change was reported between the pretest and posttest (contrast=2.14, 95% CI 1.42-2.87; P<.001), meaning that knowledge improved immediately following the workshop. In addition, knowledge improved in follow-up evaluations compared with preworkshop knowledge (contrast=1.57, 95% CI 0.84-2.30; P<.001). This result revealed an improvement in knowledge regarding the DLW framework at the post- and follow-up evaluations when compared with the baseline scores. In contrast, there was no knowledge change between the posttest and follow-up test (contrast=−0.57, 95% CI −1.30 to 0.16; P=.12), which means that knowledge remained the same 3 months after the workshop.

In the web-based group, there was a knowledge change between the pretest and posttest (contrast=2.42, 95% CI 1.70-3.14; P<.001), between the pretest and follow-up test (contrast=1.16, 95% CI 0.44-1.88; P=.002), and between the posttest and follow-up test (contrast=−1.26, 95% CI −1.97 to −0.54; P=.001). Knowledge improved at both the posttest and follow-up evaluations compared with the pretest results. However, the knowledge scores at the follow-up evaluations were lower compared with the posttest results, which means that there was some reduction in knowledge gains over time.

**Quantitative Data: Secondary Outcomes**

**Effects of the Workshops on the Factors Influencing DLW Adoption**

Unlike in the knowledge questionnaire, a lower score for the factors influencing DLW adoption did not indicate a wrong answer. Instead, it indicated the degree to which the participants disagreed with the statements in the questionnaire and perceived their capacity to adopt the DLW framework in practice; a higher score meant that the participants were more likely to use the DLW framework in their practice. The mean total score of the pretest for the factors influencing the application of the DLW framework in practice was 38.24 (SD 5.19) out of 60 for the in-person group and 33.82 (SD 6.05) out of 60 for the web-based group. This represented a statistically significant difference using a t test between the 2 groups in terms of the factors influencing the application of the DLW framework in practice (P=.01). The participants in the in-person group showed higher scores for all questions regarding influencing factors, indicating more positive perceptions of their situations that would support the adoption of the DLW in their practices. Both groups presented the lowest score on the question about how much the participants knew about the DLW framework (in-person=1.95, web-based=1.39), and the highest score was on their willingness to use the DLW framework in practice (in-person=4.9, web-based=4.76). A pretest was conducted before the participants took the DLW workshops, and both groups scored low in terms of their knowledge of the DLW framework, confidence in using it, and how well they knew the resources and experts that would help them understand the DLW framework. The participants felt that the DLW framework would be beneficial in their practice and improve the health outcomes of their clients. They also believed that the DLW framework would fit well in their practice and be easy to apply, and that coworkers would support their use of the DLW framework. The question about how much the participants knew about the DLW resources presented the largest difference in mean scores between the 2 groups. The question about whether the DLW framework would be beneficial in their practice presented the smallest gap between the 2 groups.

Immediately following the completion of the workshop, the mean total score for the factors influencing the use of the new knowledge in practice was 52.10 (SD 4.89) and 43.82 (SD 8.16) out of a maximum score of 60 in the in-person and web-based groups, respectively. Because there was a statistically significant baseline difference in the factors influencing the adoption of the DLW framework between the 2 groups (P=.01), the robust regression procedure was conducted using the pretest result as a covariate. The independent variables were the group and the mean total score at pretest, and the dependent variable was the mean total score at posttest. The robust regression result still presented a statistically significant group difference (F2,39=13.98; R2=0.5094; P=.001) after controlling for the covariate, and the participants in the in-person group presented higher scores on each item of the questionnaire. The in-person group scored an average of 5.17 more points than the web-based group after controlling for the pretest results as a covariate (Table 2).

Compared with the pretest results, both groups had increased scores for every question, except that the participants in the web-based group scored lower on the question regarding how easy it would be to apply the DLW framework in practice. Specifically, both groups presented a large increase in the questions about their knowledge of the DLW framework, confidence in its use, and the extent of their knowledge of its resources and experts compared with the pretest results.
Table 2. Robust regression of posttest for factors influencing Do-Live-Well framework adoption.

| Variable | $B^a$ (robust SE; 95% CI) | $t$ test (df) | $P>|t|$ | $F$ test (df) | $R^2$ |
|----------|--------------------------|---------------|----------|--------------|-------|
| Group    | $-5.17$ (1.48; $-8.16$ to $-2.18$) | $-3.49$ (40) | .001     | —            | —     |
| Pretest  | $0.65$ (0.14; 0.37 to 0.93) | $4.71$ (40)   | <.001    | —            | —     |
| Constant | $27.09$ (5.31; 16.36 to 37.82) | $5.11$ (40)   | <.001    | $13.98$ (2.39) | 0.5094 |

$^a$Regression coefficient.

The in-person group presented the highest score on the question regarding their willingness to use the DLW framework and the lowest score on the question regarding their confidence in using the DLW framework in their practice. The web-based group presented the highest score on the question regarding the benefit of the DLW framework and the lowest score on the question regarding the ease of using the DLW framework in their practice.

The largest difference between the groups was the question about how well they knew DLW experts; in other words, compared with the web-based group, the participants in the in-person group felt they knew the DLW experts better.

Three months after the workshop, at the follow-up evaluation of the factors influencing the adoption of the DLW framework, the in-person group presented a mean total score of 39.62 (SD 8.24), whereas the web-based group reported a mean total score of 34.77 (SD 8.72) of a maximum score of 60, respectively. The participants in the in-person group scored higher in all items, similar to the pre- and posttest results.

Robust regression was also performed, and no statistically significant difference was noted between the groups after controlling for the covariate ($F_{2,39} = 1.69; R^2 = 0.14; P = .19$; Table 3). The in-person group presented the highest score on the question regarding their belief in the positive impact of the DLW framework for the health outcomes of their clients and the lowest score on the question about their confidence in using the DLW framework in their practice. The web-based group presented the highest score on the question about their accessibility in the DLW resources and the lowest score on the question about the support of their colleagues in DLW applications.

Both groups presented decreased scores on every question compared with the posttest. The difference in the total mean score of the questions between the 2 groups mostly became smaller compared with the posttest, except for the questions about the benefit of the DLW framework in practice and the support of colleagues in its use. The largest difference between the groups was evident in the question about whether their colleagues would support their DLW application. In other words, the in-person group felt more positive about the support of their colleagues in the DLW application. The smallest difference between the groups was regarding the question about the confidence of the participants in the DLW application; the in-person group’s follow-up scores decreased compared with the posttest results. Throughout all phases (pre-, post-, and follow-up tests), the in-person group presented higher scores for all questions about the factors influencing DLW adoption.

Table 3. Robust regression of follow-up results for factors influencing Do-Live-Well framework adoption.

| Variable | $B^a$ (robust SE; 95% CI) | $t$ test (df) | $P>|t|$ | $F$ test (df) | $R^2$ |
|----------|--------------------------|---------------|----------|--------------|-------|
| Group    | $-2.73$ (2.06; $-6.90$ to 1.45) | $-1.32$ (40) | .19      | —            | —     |
| Pretest  | $0.44$ (0.28; $-0.13$ to 1.00) | $1.56$ (40)   | .13      | —            | —     |
| Constant | $25.34$ (7.85; 9.47 to 41.21) | $3.23$ (40)   | .003     | $1.69$ (2.39) | 0.14  |

$^a$Regression coefficient.

Satisfaction With the Workshops

Immediately following the workshop, the participants in the in-person group were more positive in their appraisal of the workshop (mean total score 106.38, SD 6.73) than the web-based group (mean total score 90.77, SD 16.11). The Mann-Whitney test showed a statistically significant difference between the groups in their satisfaction with the workshop ($P < .001$). The participants in the in-person group scored higher on all items asking about their satisfaction with the workshop. The in-person group was most satisfied with the skills of the instructors in encouraging participant-engagement and least satisfied with the constructive feedback of the instructors. The web-based group was most satisfied with the accessibility of the learning method and least satisfied with the constructive feedback of the instructors. The largest difference between the groups was regarding the question about the learning environment in favor of the in-person group, and the smallest difference between the groups was with regards to the question about the accessibility of learning.

Effects of the Workshops on DLW Application After the Workshops

Three months after the workshop, 43% (9/21) of the people in the in-person group said they had been using the DLW framework. In the web-based group, 27% (6/22) said they had...
been using the DLW framework. The chi-square test revealed no statistically significant difference in the use of the framework after the workshop ($\chi^2 = 1.2; P = .28$). The clinical practices of the 15 OTs applying DLW concepts from both groups were as follows: mental health (in-person group: 5/6, 83%; web-based group: 1/6, 17%); primary care (in-person group: 2/4, 50%; web-based group: 2/4, 50%); accessibility service (in-person group: 1/1, 100%); pediatrics (web-based group: 1/1, 100%); and private setting (in-person group: 1/1, 100%).

The mean frequency of the DLW framework use with clients was 2.62 (SD 2.54) for the in-person group (n=21) and 1.59 (SD 2.13) for the web-based group (n=22) on a frequency scale of 0-10. The Mann-Whitney test showed no statistically significant difference between the groups ($P = .13$). Regarding the OTs’ frequency of use of the DLW framework other than for their clients (in-person, n=21: mean=2.71/10, SD 2.47; web-based, n=22: mean=1.95/10, SD 2.30), there was no statistically significant difference between the groups ($P = .22$).

The results for all outcomes at the 3 time points are presented in Table 4.

### Table 4. Mean scores for the primary and secondary outcomes at the 3 time points.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Follow-up test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In-person (n=21), mean (SD)</td>
<td>Web-based (n=22), mean (SD)</td>
<td>In-person (n=21), mean (SD)</td>
</tr>
<tr>
<td>Knowledge regarding DLW$^a$</td>
<td>5.48 (1.75)</td>
<td>5.39 (1.69)</td>
<td>.87</td>
</tr>
<tr>
<td>Factors influencing DLW adoption</td>
<td>38.24 (5.19)</td>
<td>33.82 (6.05)</td>
<td>.01</td>
</tr>
<tr>
<td>Reaction to the workshop</td>
<td>N/A$^b$</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Use</td>
<td>Yes</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>19</td>
<td>29</td>
</tr>
<tr>
<td>Use with clients (0-10)</td>
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<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Use at an organizational level (0-10)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

$^a$DLW: Do-Live-Well.

$^b$N/A: not applicable.

### Qualitative Data

#### Participant Characteristics

In total, 18 OTs (9/18, 50% from each group), including 1 man and 17 women, participated in an individual interview an average of 14 weeks after the end of their workshop participation. Their mean age was 39.56 (SD 9.95) years, and their mean work experience was 13.44 (SD 9.57) years. Of the 18 OTs, 4 (22%) had a bachelor’s degree, and 14 (73%) had a master’s degree in Occupational Therapy. From a total of 18 OTs, 10 (56%) applied the DLW framework in their practice, and 8 (44%) did not use it. Their practice settings were as follows: mental health (6/18, 33%), primary care (2/18, 11%), hospital (2/18, 11%), and others (8/18, 44%), including education, long-term care, ophthalmology clinics, pediatric, accessibility, private practices, rehabilitation units, and veterans’ centers.

Five themes from the ideas that were discussed frequently were identified in relation to the OTs’ experience of participating in web-based and in-person workshops, focusing on its facilitators and challenges.

#### Theme 1: Relevance to One’s Practice and Interests May Improve Learning

Participants seemed to engage in learning better when the content was relevant to their practice or interests. In both the web-based and in-person workshops, the learners were able to choose the case scenario that was relevant to their practice or interests. Being able to choose the case scenario increased the learners’ motivation. In this regard, one participant in the web-based group said as follows:

*“I like the fact that I could choose one that was relevant. I think I would have a much harder time obviously with a setting or a population that I am not familiar with. So that was a nice way to learn.”* [Interviewee 18]

In addition, some participants seemed to like discussions or conversations that were directly related to their practice or interests. Some found that a downside of the in-person workshop was listening to conversations that were not directly related to their practice or interests. Unlike web-based learning, where people could freely choose what to read based on their interests, people in the in-person workshop had to sit down and listen to every conversation, which could lead to a loss of interest or
motivation for learning. One participant in the in-person group said as follows:

> I mean, I think sometimes it might have been that people were really passionate about maybe a certain area that I might not have as much interest in, so you would need to certainly wait. [Interviewee 7]

### Theme 2: A Familiar Learning Environment May Facilitate Learning

Some participants felt that they learned better when the learning environment was comfortable. Some participants in the in-person group said that they liked in-person learning because they were familiar with its environment. They described in-person learning as old school learning where their instructor was physically in front of them. Some said that the in-person workshop was a familiar learning environment, consistent with how they had studied in the past. Thus, for some learners, the familiar learning environment allowed them to easily engage in their learning because that was how they had always learned. Two participants in the in-person group expressed this by saying as follows:

> I think it is the familiarity and how I am used to learning because of that I can adapt. [Interviewee 3]

> Oh, I learn better if the person is actually in front of me. [Interviewee 5]

Often with in-person learning, learners are provided with printed materials. During our in-person DLW workshop, we also provided a printed workbook, and this paper-based material seemed to allow learners to better focus on their learning. One participant in the in-person workshop said as follows:

> Having paper-based materials typically right in front of me as well is helpful. That is how I typically retain information better. This brain of mine functions better. [Interviewee 9]

An electronic version of the workbook was provided to participants in the web-based workshop. One participant in the web-based workshop felt less familiar with the web-based learning environment and used her own learning strategy to overcome the challenges she experienced. The participant mentioned that it was not easy for her to go back and forth between the webpages to find an appropriate reference to answer the discussion questions. Thus, she used her own notes and wrote down the key point of the lecture, which she used to answer the discussion questions. In this way, she made the web-based context more familiar to her own learning style to enhance her engagement with the material. She said the following:

> I do like the website format and kind of like typing out responses, but a downside to that is that I kind of always had to reference material from different pages to look at my answers again. What I found helpful is just like I just kind of write my own notes on the side and I refer to that when I write the answers. [Interviewee 13]

### Theme 3: Synchronous Interaction Is Valuable in the Learning Process

Participants in both the web-based and in-person workshops found synchronous interaction to be a great facilitator of their learning. They mentioned that nonverbal communication cues were important in their learning. One participant said as follows:

> I feel like the in-person, the face-to-face interactions would allow me to take in cues that you may not necessarily be able to get when you are doing even the phone call or teleconference. I truly believe that there is a lot of information in nonverbal communication. [Interviewee 8]

In addition, dynamic discussions seemed to be another important aspect of learning, whereby learners actively exchanged opinions with peers and instructors on various topics regarding the DLW framework. This active process of sharing thoughts exposed them to different perspectives that they had not previously encountered. One participant shared her thoughts regarding dynamic discussions:

> I think that for me it is the discussions, from hearing others’ point of view, and then how other people apply it to situations that I might not even have thought of. [Interviewee 3]

In contrast, one participant in the web-based group said that there was no opportunity for dynamic discussions in web-based learning:

> [In online learning] you cannot build as much on top of other people’s things. So, you get to see more of what people are saying, but you cannot brainstorm together. [Interviewee 14]

Furthermore, being able to ask questions the moment they had them was another facilitator in the participants’ learning. If learners had questions about the content, the learners in the in-person group could immediately ask the instructor. However, unlike the in-person learning environment, it was not easy to ask a question in real time through the web-based learning platform. One participant in the web-based group said as follows:

> Because it [online learning] was offered asynchronously you did not necessarily have a chance to ask a question at the moment if there was a question. [Interviewee 15]

Similarly, participants liked to receive immediate feedback from peers or instructors during their learning. One participant in the in-person group said:

> I really liked to have immediate feedback from not just the peers but also the organizers of the workshop. [Interviewee 8]

Finally, the learners in the in-person workshop liked to meet other OTs from different practice settings. One participant in the in-person group said as follows:

> I really enjoyed meeting other people in that course and seeing what they are doing in their practice. I think a lot of them had a unique OT role and also,
In contrast, one participant in the web-based group expressed that the web-based workshop did not provide the same quality networking opportunities as the in-person workshop:

The disadvantage [of online learning] is that you do not necessarily get that face-to-face networking quality. [Interviewee 18]

Theme 4: Ease of Access to Learning Should Be Considered

Accessibility to learning seemed to be an important aspect that educators should consider when providing educational opportunities. The participants in both the web-based and in-person workshop groups identified some benefits and challenges of accessing each learning format.

First, the participants in the in-person workshop group mentioned that commuting was a challenge in accessing the workshop location. For learners who did not have cars, commuting to the workshop location was difficult. In addition, the cold winter weather in Canada affected their access to learning. Two participants in the in-person group commented the following:

The challenge is the commute time. Driving there, at the parking, getting the day off work to do it. [Interviewee 1]

I think the weather was not that nice. It was cold. I mean the commute was not that bad from Toronto to Hamilton but obviously, that would have deterred quite a few people if they do not have a car or it is too far to be able to access. [Interviewee 5]

Some participants in the web-based workshop group mentioned that the web-based workshop was a safe way of learning. Owing to the COVID-19 pandemic, web-based education has been considered a safe and primary route by which learners can take courses without worrying about risks. One participant in the web-based group said:

I think benefits of online is that, like especially in this COVID season, you can be safe and like kind of not be at risk of being exposed to COVID for sure. [Interviewee 13]

In addition, learners in the web-based group said that a benefit of web-based learning was that it was free from geographical restrictions. Some learners took the web-based courses in Alberta and even while traveling outside of Canada; thus, learners took courses wherever they had internet access, which made learning more accessible for them. One participant in the web-based group expressed as follows:

I am in Kingston...being able to take it here and in Argentina, that was beneficial. [Interviewee 14]

However, if the learner did not have the necessary equipment to take the web-based class, such as internet access and a computer, there were restrictions on taking the course itself, which affected learning. Regarding this equipment requirement and its inherent challenges, a participant in the web-based group said: “It was finding a computer that I can use because I do not have my own computer” [Interviewee 10].

Theme 5: Flexibility in Web-Based Learning Can Be Both Beneficial and Challenging

According to the opinions of the participants in the web-based workshop group, the flexibility of web-based learning seemed to be both an advantage and a disadvantage. First, self-paced learning was found to be a facilitator of their learning process. In web-based learning, learners could choose the best time of the day to take the course, which possibly decreased potential distractions. Moreover, learners were able to control the speed of learning based on their individual learning styles. A participant in the web-based group shared her thoughts:

I would say that you can do it at your own pace. So if you have a setting like I do, where you can have interruptions, you think you might have a certain amount of time to set aside, but you then are interrupted with something that you would like to do or it needs to be done, that you can go ahead and do that, and then you can continue your learning. [Interviewee 10]

Another benefit of web-based learning was repeatability. In web-based learning, learners could repeat the course whenever they wanted. For example, they could repeat the specific content that they did not understand well, and this ability to repeat the course helped learners better understand and remember the content. One participant in the web-based group shared her experience of being able to repeat the content:

I liked that I could actually review the videos. I went back to watch them a few times to remind myself what you think. I think I actually went back with one of the later parts of it and went back and watched it again one of the earlier ones. I like that aspect to which I do not think you could do in an in-person setting. You would have to just remember what was happening. [Interviewee 16]

However, the flexibility of learning also hindered the learning process because some learners procrastinated on completing the course. The learners postponed taking the web-based course for various reasons. One participant in the web-based group said:

I think I procrastinate. I think it is easier to not set a time to do it. Whereas if it is in-person you are just there. You do not have an option. Okay, you go. For the most part or that is the only time they are offering it. So that is the time you have to get up. [Interviewee 14]

Some participants also had difficulty prioritizing taking the web-based course over other tasks, which affected their overall engagement in learning. A participant in the web-based group expressed the difficulty of prioritizing as follows:

So, for me, making it a priority was a bit of a challenge, because I had the flexibility to do it whenever, I did end up doing most of it like the night before it closed. So that was not necessarily how I...
Discussion

Principal Findings

Considering the appeal and current popularity of web-based learning, we examined the effectiveness of a web-based PBL-based DLW workshop compared with a PBL-based in-person DLW workshop. We also gained insights into learners’ perspectives on their participation in both learning formats. The quantitative data showed no statistically significant difference between the groups in knowledge change at the 3 time points (pre-, post-, and follow-up testing), but there was a reduction in knowledge over time in the web-based group. A statistically significant difference was present in factors influencing DLW adoption and satisfaction with the workshop at posttest. However, there was also no difference in the use of the DLW framework 3 months after the workshops. We also identified the key aspects of the learning experience of the participants through our qualitative data: relevance to practice and interest, a familiar learning environment, synchronous in-person interaction, ease of access to learning, and flexibility in web-based learning.

Similar to a recent review of the effectiveness of web-based learning compared with traditional in-person learning for health care professionals [17], the quantitative results about knowledge change showed no differences in knowledge gained between the groups [17]. This suggests that web-based learning is as promising as traditional learning for obtaining knowledge. Undoubtedly, acquiring knowledge is important for health care professionals, as they need foundational knowledge to solve various clinical problems in practice [31]. The participants in our study who attended the in-person workshop had a more satisfying learning experience in all aspects of the workshop based on our quantitative results. Bray et al [32] identified that learners considered interaction as an important factor that led to learning satisfaction. This is reinforced by our qualitative findings, in which participants highlighted the importance of interaction with instructors and peers in the learning process. There were no synchronous interactions in the web-based workshop in our study; thus, as shown by our satisfaction results, the participants in the web-based groups who felt the lack of personal interactions might have been less satisfied with the workshop. In addition, this aspect of social interaction may influence the long-term effect of knowledge retention. This study reported a reduction in knowledge in the web-based group over time, albeit not statistically significant. Real-time social interactions have reported the effectiveness of learning by helping learners “organize their thoughts, reflect on their understanding, and find gaps in their reasoning” [33]. Thus, a lack of synchronous interactions with peers and instructors may negatively impact the knowledge retention and satisfaction of the learners in the web-based group.

Regarding the factors influencing the DLW concepts in practice, immediately after the workshop, the participants in the in-person workshop seemed to be more positive toward the DLW application in their practice; however, 3 months after the workshop, there was no statistically significant difference in the factors influencing DLW adoption between the groups. At the time of the research, the COVID-19 pandemic resulted in significant disruptions in the practice contexts of the OTs, and learners’ perceptions of the DLW application might have been affected by the COVID-19 pandemic. The participants who believed that the DLW could be incorporated into their practice faced barriers to its use during COVID-19 pandemic restrictions and changes to their practice. Many in-person programs were canceled, and OTs were busy dealing with urgent situations and changed policies, which may have resulted in decisions not to implement DLW concepts as planned.

Immediately after the DLW workshops, there was the largest difference between the 2 groups regarding the question about how well the participants knew the DLW experts. Compared with the in-person workshop, where the participants could meet and talk with the DLW experts, the participants in the web-based group may have given this question a lower score because they did not have the same opportunity to meet the experts in person. However, this difference between the 2 groups did not last 3 months after the workshops, as indicated by the decreased score in the in-person group. Only 1 person from the web-based group contacted the DLW team after the workshop, and it is expected that even though the participants in the in-person group believed they knew the DLW experts well immediately after the workshop, this impression did not last for 3 months because they did not maintain connections with the experts after the workshop. A recent survey study of the preferences of OTs in continuing education shows that OTs want to receive ongoing individual support even after their education has ended [34]. Thus, we recommend that educators provide a way for learners to stay connected with experts in new knowledge even after disseminating the knowledge. A possible way to connect learners and experts is mentorship. Mentor-mentee programs have been used in occupational therapy education to support the growth of less experienced OTs in professional skills [35,36]. A case study reported that a novice OT found mentorship helpful in applying knowledge to real-world practice, leading to the professional growth of the OT [36]. Thus, having a regular meeting or follow-up check-in opportunity may allow learners to feel connected to the DLW experts, enabling them to sustain their knowledge and support them in applying what they have learned.

The relevance of knowledge to clinical practice and interest was emphasized in our qualitative findings. Regardless of the type of workshop learners participated in, quantitative and qualitative findings suggest that being able to choose a case scenario related to their practice and interest was helpful in their learning process. In a review of learning theories and education for health care professionals, Abela argues that the relevance of knowledge to clinical practice and interest was helpful in their learning process. Many in-person programs were faced barriers to its use during COVID-19 pandemic restrictions and changes to their practice. The participants who believed that the DLW could be incorporated into their practice faced barriers to its use during COVID-19 pandemic restrictions and changes to their practice. Many in-person programs were canceled, and OTs were busy dealing with urgent situations and changed policies, which may have resulted in decisions not to implement DLW concepts as planned.

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Our quantitative results revealed that in-person learners appreciated the various elements of the satisfaction questionnaire more positively. This may be the result of the learning preferences of the participants before attending the workshops; both the in-person and web-based groups preferred in-person learning at the pretest. Web-based learners who preferred the in-person learning format may have been less satisfied with the web-based learning format.

In the satisfaction questionnaire, the accessibility of web-based learning was the component with which web-based learners were most satisfied. In the literature, accessibility has been recognized as a great benefit of web-based learning by allowing anyone to access learning materials without restrictions [39]. This benefit of accessibility was made more evident by our qualitative findings. The web-based workshop participants appreciated that they could participate in learning without regional restrictions. Even when traveling abroad during the study period, a participant could take the web-based DLW courses. The benefit of this accessibility would make learning easier for international learners or learners in remote areas who want to learn more about the DLW framework. Therefore, web-based education will help educational institutions or associations that want to attract global learners. Access to reliable internet and web-based learning equipment is important for web-based learning [40]. Since the COVID-19 outbreak, many people have been working from home or taking web-based courses. If a person does not have their own computer and instead shares one with other family members, they may need to wait until the other family members finish using the computer, which may prevent a person from accessing the web-based courses. Thus, access to internet and web-based learning equipment should be considered for web-based learners.

The learners in the web-based group valued the flexibility provided by web-based learning, given that they could take and repeat the modules whenever they wanted because the workshop materials were provided asynchronously. The benefits of the asynchronous feature of web-based learning were that it supported different learning styles and preferences [41]. However, web-based learners stated that the flexibility of web-based learning also hindered their learning. Participants in the web-based workshop found it difficult to prioritize web-based learning over other tasks. Adult learners have responsibilities at home and at work, and they are often placed in a variety of situations that impede learning [42]. Thus, the flexibility of web-based learning seemed to allow learners to prioritize other tasks over web-based courses, resulting in them not having enough time to take the courses. In both the post- and follow-up evaluations, 7 people did not complete the evaluations. Although it was not known whether the participants who did not complete the evaluations completed the web-based courses, the dropout rate in the web-based group may indicate that the flexibility of the web-based learning environment could negatively affect the completion of web-based courses. Moreover, web-based learners in this study seemed to procrastinate in the web-based course; learners’ procrastination has been a major disadvantage of web-based learning [43] and it has a negative effect on learners’ perceptions of the effectiveness of web-based learning [44].

In our qualitative findings, the lack of ease in networking with others was identified as a challenge of web-based learning. New knowledge is disseminated through communication channels within a social system [26], and educators would need to think of providing the best way to enable learners to communicate with educators and their peers. In our study, although we provided an internet-based space for web-based learners to communicate with each other, the quality of asynchronous communication may be different from that of synchronous communication. The importance of synchronous interactions was emphasized through the interviews with participants in both the web-based and in-person workshops. Thus, adding synchronous communication to web-based learning may benefit learners by encouraging them to engage in their learning more actively. In the literature, an opportunity to have synchronous communication allowed learners to discuss the content in-depth and kept them feeling an urgency for learning [45] and, therefore, may contribute to the successful completion of web-based courses. Furthermore, synchronous communication is more related to the social aspect of learning than asynchronous communication [46]. Considering that OTs value the social aspect of learning [16], future research on continuing education for OTs should include synchronous communication via video conferences or live chats to maximize benefits. By doing so, learners may have more time to absorb and reflect on what they have learned and to enhance and validate their understanding by asking questions and receiving immediate feedback.

**Strengths**

To our knowledge, no studies have examined the effectiveness of web-based continuing learning with a comparison group of in-person learners specifically for OTs. This study provided quantitative findings, and the authors were able to directly hear the perspectives and learning experiences of the participants in both web-based and in-person learning environments. We believe this study can support occupational therapy educators in developing and providing effective web-based education by understanding the advantages and disadvantages of the 2 different educational methods.

**Limitations**

The web-based workshop platform allowed us to identify which participants joined the discussion forums and to see their login information via the workshop website, but we did not know if the participants completed all the course materials. Although we assumed that those who did not complete the postevaluation might not have completed the web-based course, postworkshop evaluation is not an accurate indicator of successful completion of the course. Thus, for future educational studies examining the effectiveness of web-based education, researchers should track learners’ course completion, if possible. Unless preinstalled software to track learners’ completion is available, researchers may need to ask the participants directly about course completion. In addition, all questionnaires used to measure the outcomes of this study were developed specifically for this study, and thus the reliability and validity of the questionnaires themselves have not been demonstrated. Future studies could focus on developing standard measures to evaluate the effectiveness of educational interventions. In addition, this study

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(page number not for citation purposes)
was conducted in Hamilton, Canada, but participants were recruited from across Canada. We were not able to randomize the participants because OTs far from the study site could not be included in the in-person group. Future studies may consider offering both web-based and in-person workshops to all participants and then randomize them.

Conclusions
This study suggests that web-based education can be effective for OTs, as web-based education enables learners to acquire a similar level of knowledge compared with in-person education. In addition, each educational method has strengths and barriers identified by the learners. Adding a synchronous feature and a mentor or individual follow-up to web-based learning may facilitate more active involvement by participants in their learning, resulting in a more positive web-based learning experience.

Conflicts of Interest
None declared.

Multimedia Appendix 1
Prequestionnaire.
[DOCX File, 88 KB - mededu_v8i1e31634_app1.docx]

Multimedia Appendix 2
Postquestionnaire.
[DOCX File, 51 KB - mededu_v8i1e31634_app2.docx]

Multimedia Appendix 3
Follow-up questionnaire.
[DOCX File, 46 KB - mededu_v8i1e31634_app3.docx]

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Abbreviations

- **DLW**: Do-Live-Well
- **OT**: occupational therapist
- **PBL**: problem-based learning

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Social Determinants of Health Screening by Preclinical Medical Students During the COVID-19 Pandemic: Service-Based Learning Case Study

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Abstract

Background: The inclusion of social determinants of health is mandated for undergraduate medical education. However, little is known about how to prepare preclinical students for real-world screening and referrals for addressing social determinants of health.

Objective: This pilot project’s objective was to evaluate the feasibility of using a real-world, service-based learning approach for training preclinical students to assess social needs and make relevant referrals via the electronic medical record during the COVID-19 pandemic (May to June 2020).

Methods: This project was designed to address an acute community service need and to teach preclinical, second-year medical student volunteers (n=11) how to assess social needs and make referrals by using the 10-item Social Determinants of Health Screening Questionnaire in the electronic health record (EHR; Epic platform; Epic Systems Corporation). Third-year medical student volunteers (n=3), who had completed 6 clinical rotations, led the 2-hour skills development orientation and were available for ongoing mentoring and peer support. All student-patient communication was conducted by telephone, and bilingual (English and Spanish) students called the patients who preferred to communicate in Spanish. We analyzed EHR data extracted from Epic to evaluate screening and data extracted from REDCap (Research Electronic Data Capture; Vanderbilt University) to evaluate community health workers’ notes. We elicited feedback from the participating preclinical students to evaluate the future use of this community-based service learning approach in our preclinical curriculum.

Results: The preclinical students completed 45 screening interviews. Of the 45 screened patients, 20 (44%) screened positive for at least 1 social need. Almost all of these patients (19/20, 95%) were referred to the community health worker. Half (8/16, 50%) of the patients who had consultations with the community health worker were connected with a relevant social service resource. The preclinical students indicated that project participation increased their ability to assess social needs and make needed EHR referrals. Food insecurity was the most common social need.

Conclusions: Practical exposure to social needs assessment has the potential to help preclinical medical students develop the ability to address social concerns prior to entering clinical clerkships in their third year of medical school. The students can also become familiar with the EHR prior to entering third-year clerkships. Physicians, who are aware of social needs and have the electronic medical record tools and staff resources needed to act, can create workflows to make social needs assessments and services integral components of health care. Research studies and quality improvement initiatives need to investigate how to integrate screening for social needs and connecting patients to the appropriate social services into routine primary care procedures.
The social determinants of health focus on “the conditions in which people are born, grow, live, work and age” and include employment, food security, housing security, access to health care, and transportation as potential contributors to poor health outcomes [1]. Health systems are struggling with how to improve health equity and train care providers to assess social determinants of health and make appropriate referrals in clinical practice [2-10]. The need for social determinants of health screening increased dramatically with the advent of the COVID-19 pandemic in 2020 [11-15]. As stay-at-home orders were instituted, the unemployment rate rose to 20.4% in the New York epicenter by June 2020 [15].

The impact of COVID-19 on health care and medical student training in the United States was dramatic. Health care providers were transferred from outpatient care to inpatient care to manage the influx of gravely ill patients with COVID-19. The Association of American Medical Colleges (AAMC) recommended that medical students be removed from all in-person clinical activities [14]. This left medical students with time for pursuing learning opportunities that do not involve in-person clinical activities.

The AAMC has stressed the importance of service orientation as a core competency that strengthens medical school and residency applications. Community-based service learning activities can facilitate the development of competencies, such as cultural competence and teamwork as well as service orientation, that are needed to improve health equity. The AAMC website suggests that both undergraduate and graduate medical education programs are looking for applicants who “demonstrate a desire to help others and sensitivity to others’ needs and feelings; demonstrate a desire to alleviate others’ distress; [and] recognize and act on [their] responsibilities to society; locally, nationally, and globally” [16]. The motivation to become a physician frequently comes from a desire to help people. Taking a service year prior to medical school is recommended by the AAMC as a way to make a positive impact on people though work. AAMC-suggested activities for a gap service year have included tutoring children, caring for older adults, supporting veterans, aiding people who are homeless, or helping communities recover from natural disasters. These AAMC-suggested community-based service learning activities generally involve in-person contact. The AAMC did not issue guidance for alternative service activities for medical students, who suddenly had gap time after being removed from in-person clinical activities. However, telehealth can provide opportunities for students to participate in community-based service learning that does not involve in-person clinical activities.

This case study describes the telehealth activities of medical student volunteers who used a social needs screening questionnaire and community health worker referrals to provide patient assistance in a primary care practice setting during the height of the COVID-19 pandemic crisis in New York. The objective of our case study was to evaluate the feasibility of using real-world, service-based learning to teach preclinical medical students how to interview patients by telephone, assess social needs, make appropriate referrals, and enter relevant information into patients’ electronic health records (EHRs).

### Methods

#### Setting

This case study describes our work with a primary care practice that provides safety net services as a federally qualified health center and serves as a teaching site within a large urban health system. This health center provides clinical services related to family medicine, internal medicine, pediatrics, obstetrics and gynecology, psychiatry, mental health, and social services and has primary care teams that include community health workers [17]. These services are included as part of the clinical rotations for medical students, and this health center is 1 of the 20 primary care practice teaching sites located in the Bronx and Westchester County, New York.

#### Patient Population

The medical director identified patients (n=53) for social determinants of health telephone screening based on the following criteria: patients aged ≥50 years, those who were due for colorectal cancer screening (via colonoscopy), and those who did not have insurance. Due to the acuity of the pandemic crisis and the need to screen and intervene on the needs of a large patient population, the contact list provided was based on readily available clinic data (eg, patients due for colonoscopy), and the medical director focused on patients without health insurance for outreach purposes.

#### Role of Medical Student Volunteers

Preclinical, second-year medical student volunteers (n=11) were recruited via email. Third-year medical student volunteers (n=3), who had completed 6 clinical rotations, developed and led a 2-hour skills development training workshop for the preclinical second-year students. The workshop PowerPoint slides are in Multimedia Appendix 1. The learning objectives included being able to (1) navigate the Epic platform (Epic Systems Corporation) EHR, (2) screen for social needs, and (3) refer patients to the appropriate care providers. If potential domestic violence was a concern for a patient, they were referred to a social worker; patients with other social needs were referred to the community health worker. The training addressed how to sensitively approach patients about social needs screening. The...
third-year medical students provided ongoing mentoring, peer support, and guidance (ie, they answered questions) for contacting patients via telephone, conducting patient interviews, and documenting the Social Determinants of Health Screening Questionnaire assessments and related referrals via the Epic portal.

**Preclinical Training: Social Determinants of Health and Community-Based Service Learning**

Preclinical medical students have varying degrees of exposure to opportunities for learning about social determinants of health–related topics and developing skills for addressing socially determined health disparities. Exposure is provided via the medical school curriculum, and skills can be acquired by volunteering in community-based service learning projects. Embedded in the first 2 years of the medical school curriculum is the Introduction to Clinical Medicine longitudinal course. The topics addressed in this course include patient health literacy, HIV, social determinants of health, and substance abuse. Interviewing skills for obtaining a sexual history are taught via practice mock interviews with standardized patients. The medical school volunteer opportunities are available through the Community-Based Service Learning program, which is comprised of a network of student-initiated projects, including the sponsoring of a community garden and a wide variety of community education projects. Students also have the option of volunteering at the Einstein Community Health Outreach clinic, which is a largely medical student–run free clinic that aims to provide quality care to uninsured patients. Preclinical medical student volunteers at the Einstein Community Health Outreach clinic serve a variety of roles that frequently involve screening for social needs.

**The 10-Item Social Determinants of Health Screening Questionnaire and Referral Procedures**

In 2017, a multidisciplinary committee within the health system used the suggested procedures from the Health Leads Social Needs Screening Toolkit [18] to develop a 10-item Social Determinants of Health Screening Questionnaire (Table 1). Clinically validated question items from the toolkit’s screening library were chosen to assess the essential social needs domains (housing instability, utility strain, food insecurity, transportation, financial resources strain, and exposure to violence) and 2 optional social needs domains (childcare and behavioral and mental health). The questionnaire’s reading level was slightly below the sixth-grade reading level (Flesch-Kincaid grade level of 5.9); Microsoft Word Editor was used to calculate readability statistics [19]. To accommodate the language diversity within the health system, the questionnaire was translated into 9 languages.

**Table 1. Social Determinants of Health Screening Questionnaire.**

<table>
<thead>
<tr>
<th>Social needs domain</th>
<th>Screening questions with “yes/no” response options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing instability</td>
<td>Question 1: “Are you worried that in the next two months you might not have a safe place to live? (eviction, kicked out homelessness)”</td>
</tr>
<tr>
<td>Housing quality</td>
<td>Question 2: “Are you worried that the place you are living now is making you sick? (has mold, bugs, rodents, water leaks, not enough heat)”</td>
</tr>
<tr>
<td>Utility strain</td>
<td>Question 3: “In the last 3 months, has the electric, gas, oil or water company threatened to shut off services to your home?”</td>
</tr>
<tr>
<td>Food insecurity</td>
<td>Question 4: “In the last 12 months, did you worry that your food could run out before you got money to buy more?”</td>
</tr>
<tr>
<td>Transportation</td>
<td>Question 5: “In the last 3 months, has lack of transportation kept you from medical appointments or getting your medication?”</td>
</tr>
<tr>
<td>Financial resources strain</td>
<td>Question 6: “In the last 3 months, did you skip buying medication or going to the doctor’s appointment to save money?”</td>
</tr>
<tr>
<td>Childcare</td>
<td>Question 7: “Do you need help getting childcare or care for an elderly or sick adult?”</td>
</tr>
<tr>
<td>Legal</td>
<td>Question 8: “Do you need legal help? (child family services, immigrations, housing, discrimination, domestic issues, etc.)”</td>
</tr>
<tr>
<td>Behavioral and mental health</td>
<td>Question 9: “Are you finding it so hard to get along with a partner, spouse, or family member that it is causing you stress?”</td>
</tr>
<tr>
<td>Exposure to violence</td>
<td>Question 10: “Does anyone in your like hurt you, threaten you, frighten you or make you feel unsafe?”</td>
</tr>
</tbody>
</table>

This domain is identified as an essential social needs domain in the Health Leads Toolkit [18].

This domain is identified as an important social needs issue by the multidisciplinary committee of the health system.

This domain is identified as an optional social needs domain in the Health Leads Toolkit [18].

The 10-item Social Determinants of Health Screening Questionnaire was integrated into the EHR across the entire health system in 2018. The health system uses paid, trained, and supervised community members to provide health education and coaching, assistance with clinical services, and community resource connections [20]. However, practice sites within the system determine their own procedures for using the EHR Social Determinants of Health Screening Questionnaire and criteria for community health worker referrals. The practice site that participated in this pilot project had not incorporated a systematic procedure for administering the Social Determinants of Health Screening Questionnaire.
of Health Screening Questionnaire during clinical procedures by the onset of the COVID-19 pandemic in early 2020.

**Plan-Do-Study-Act Framework**

The Plan-Do-Study-Act framework [6] was used to inform how we developed and evaluated the project, which was designed to help the practice site with social needs screening and to provide real-world, service-based learning for preclinical medical student volunteers during the COVID-19 shutdown. Our process steps are outlined below.

**Plan**

Third-year medical students collaborated with the medical director, social worker, and community health worker from the clinical site to develop the project procedures and training program. The planning process addressed procedures for conducting the telephone interviews, entering patient responses into the EHR, and referring patients with social needs to the social worker and community health worker.

**Do**

Preclinical, second-year medical student volunteers were recruited by email. They participated in a 2-hour skills development orientation that taught them how to navigate the Epic platform EHR, screen for social needs, refer patients with social needs, and approach sensitive topics empathetically. The third-year medical students provided ongoing mentoring, peer support, and guidance (ie, they answered questions) for contacting patients via telephone and conducting patient interviews. The preclinical students conducted 47 social needs screening phone interviews and referred 20 patients.

**Study**

We evaluated screening outcomes by using the data extracted from the patients’ EHRs as well as project-specific data. Students’ feedback was obtained to evaluate the pilot project and to elicit recommendations for using service-based learning as a modality for increasing preclinical students’ knowledge and skills related to social determinants of health.

**Act and Adjust**

The lessons learned from this pilot project are being used to inform curriculum planning for preclinical courses that address social determinants of health. The project findings provide insights for future quality improvement initiatives and research that focuses on social needs within the context of health care.

**Social Determinants of Health Screening Telephone Calls**

Social determinants of health screening was performed by the preclinical medical students via telephone; the calls were conducted in patients’ preferred language (English or Spanish). Bilingual students called patients who preferred to communicate in Spanish. Our feasibility case study focused on screening calls conducted during May and June 2020. All calls were made by using clinic-approved cellphone apps (eg, Doximity [Doximity Inc]) affiliated with the clinic’s telephone number. Patients responded to the ten social risk questions by answering “yes” or “no” to each of the items in the screener. Patients who answered “yes” to any item were referred to an appropriate care provider. Referrals were made to a trained and supervised community health worker, who was an embedded staff member of the participating practice site. The site’s community health worker linked patients and their households to the appropriate community, state, and federal resources. For patients who preferred to communicate in Spanish, the community health worker, who was not bilingual, used a telephone translation service. Any patient who expressed any safety concerns (eg, domestic violence) or exhibited relationship stress was referred directly to a social worker for assistance and was not included in the analysis.

**Data Extraction and Institutional Review Board Approval**

For this project, the social determinants of health screening data were extracted by an analytics team and provided to administrative and medical directors within the ambulatory network for quality improvement investigation–related activities. These data included patients’ responses to the Social Determinants of Health Screening Questionnaire; dates of visit encounters; and patients’ medical record numbers, which facilitated linkages to other databases. This project was reviewed and approved by the Montefiore-Einstein Institutional Review Board (approval number: 2017-8434).

**Primary Outcomes and Covariates**

The primary outcomes for this project were the number of screenings completed and referral status (ie, patients’ uptake of social services that were recommended by the community health worker). Completed screenings were defined as screenings in which patients answered all 10 questions. Community health worker referrals were categorized as either successful or unsuccessful. A referral was successful if the community health worker helped a patient access at least 1 resource related to a screened social need. If a patient had self-identified social needs but the community health worker encounter did not facilitate access to relevant resources, the referral was categorized as an unsuccessful referral. Independent covariates were extracted from the REDCap (Research Electronic Data Capture; Vanderbilt University) database [21] based on patients’ self-reports and included sex; age; race and ethnicity; preferred spoken language; and social need categories, including housing needs, benefit needs, youth and family service needs, legal needs, and “other” needs. Comments in REDCap were used to describe needs in the “other” category. These needs were not specific, and these comments included the term social need or community resource.

**Results**

**Questionnaire and Demographic Data**

Questionnaire and demographic data were retrieved via Epic. Hispanic and non-Hispanic Black patients constituted the majority of patients (37/45, 82%). Of the 45 patients who had screening data, 20 had at least 1 social need. Almost all of the patients with a social need (19/20, 95%) were referred to the community health worker, who reached most of them (16/19, 84%) to provide a social needs consultation between May and October 2020. Table 2 summarizes the demographic
characteristics and outcomes of all patients who completed screening. Patients who were successful in obtaining social needs resources tended to be older than those who were unsuccessful. Spanish-speaking patients constituted 38% (3/8) of the patients who were unsuccessful in obtaining social needs resources.

As shown in Table 3, the majority of patients (13/16, 81%) had 1 social need identified. The most common social need was food insecurity, which was reported by half (8/16, 50%) of the patients who had consultations with the community health worker and was irrespective of whether the referral was successful.

### Table 2. Social determinants of health screening, community health worker referrals, and success in obtaining needed social service resources.

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>Completed screening (n=45)</th>
<th>No social needs identified (not referred; n=25)(^a)</th>
<th>Community health worker referral consultations (n=16)(^b,c)</th>
<th>Successful in obtaining social service resources (n=8)</th>
<th>Unsuccessful in obtaining social service resources (n=8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean (SD)</td>
<td>60 (5.7)</td>
<td>60 (5.1)</td>
<td>58 (6.5)</td>
<td>54.5 (6.6)</td>
<td></td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>19 (42)</td>
<td>13 (52)</td>
<td>2 (25)</td>
<td>1 (13)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>26 (58)</td>
<td>12 (48)</td>
<td>6 (75)</td>
<td>7 (88)</td>
<td></td>
</tr>
<tr>
<td>Race and ethnicity, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>21 (47)</td>
<td>8 (32)</td>
<td>5 (63)</td>
<td>6 (75)</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>16 (36)</td>
<td>12 (48)</td>
<td>1 (3)</td>
<td>2 (25)</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>2 (4)</td>
<td>1 (4)</td>
<td>1 (3)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>1 (2)</td>
<td>0 (0)</td>
<td>1 (3)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Asian or Pacific Islander</td>
<td>1 (2)</td>
<td>1 (4)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Other or unknown</td>
<td>4 (9)</td>
<td>3 (12)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Preferred spoken language, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>34 (69)</td>
<td>21 (84)</td>
<td>4 (50)</td>
<td>5 (62)</td>
<td></td>
</tr>
<tr>
<td>Spanish</td>
<td>14 (31)</td>
<td>4 (16)</td>
<td>4 (50)</td>
<td>3 (38)</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)Patients who responded to all of the social needs questions were not referred to the community health worker. 

\(^b\)A total of 3 patients were lost to follow-up or did not report having social needs during the community health worker assessment; therefore, they were not included in the analysis.

\(^c\)One patient expressed concerns regarding personal safety, was referred to the social worker rather than the community health worker, and was excluded from the analysis.

### Table 3. Community health worker consultations.

<table>
<thead>
<tr>
<th>Social needs</th>
<th>Patients who were successful in obtaining social service resources (8/16, 50%), n (%)</th>
<th>Patients who were unsuccessful in obtaining social service resources (8/16, 50%), n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of social needs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>7 (88)</td>
<td>6 (75)</td>
</tr>
<tr>
<td>2</td>
<td>0 (0)</td>
<td>1 (13)</td>
</tr>
<tr>
<td>3</td>
<td>1 (13)</td>
<td>1 (13)</td>
</tr>
<tr>
<td>Type of social needs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food insecurity</td>
<td>4 (50)</td>
<td>4 (50)</td>
</tr>
<tr>
<td>Housing(^a)</td>
<td>1 (13)</td>
<td>2 (25)</td>
</tr>
<tr>
<td>Other needs</td>
<td>4 (50)</td>
<td>5 (63)</td>
</tr>
</tbody>
</table>

\(^a\)This need was related to applying for a bed in a shelter or for public housing.
Students’ Feedback

The second-year preclinical student volunteers indicated that their motivation for participating in this project came from the desire to do something concrete and useful during the COVID-19 pandemic and the recognition of their lack of clinical experience and limited capacity to help in clinical settings. Students’ feedback also addressed how the experience helped to expand their clinical skills, as indicated in the following comment:

…there is a piece of your education that has to be about how you talk about social determinants of health…but there is another piece where now that you’ve identified a need, what are you going to do...Those are two different skill sets and I think I got practice with both of those things by doing the calls.

The preclinical student volunteers supported adding more service-based initiatives and more formal social determinants of health training to the curriculum. One comment focused on how aspects of their medical education were both similar to and different from their real-world project experience, as follows:

We do a lot of talking [in medical school] about what are the social determinants of health…but there are gaps in understanding what the particular needs are in a particular community and talking to patients about them, which can be really tough. It is kind of like taking a sexual history. The first time you do it, it feels very awkward and invasive...you really have to do it multiple times to learn how to do it well...often maybe we are doing it [asking social needs questions] for the first time as third years….

Discussion

Main Results

The preclinical medical student volunteers indicated that participating in this service-based learning project increased their ability to assess social needs and make social service referrals by using the EHR 10-item Social Determinants of Health Screening Questionnaire. Of the patients with a social need, 80% (16/20) had a consultation with the community health worker, and half of these patients (8/16, 50%) were connected to at least 1 resource to address their social needs. About one-third (14/45, 31%) of the total patients who were screened preferred to speak Spanish, but Spanish-speaking patients constituted 38% (3/8) of the patients who were unsuccessful in obtaining social needs resources after their community health worker consultation. All of the community health worker consultations with patients who preferred to communicate in Spanish were conducted via a translation service because the community health worker was not a Spanish speaker.

Comparison With Prior Work

Fiori et al [2,3] used a similar social determinants of health survey and reported a successful social service uptake (ie, social services recommended by the community health worker) rate of 43%; the screening surveys were completed in the waiting rooms of a pediatric ambulatory clinic, and the primary care physician reviewed the surveys with the patients. Although addressing the five major social determinants of health (food security, housing access, transportation issues, utility needs, and interpersonal violence) can improve patient outcomes, a 2019 paper by Fraze et al [4] reported that only about 16% of physician practices in the United States screen for all 5 domains. Medical training needs to address how to integrate an empathetic discussion of social needs as a standard of care. Taking a sexual history in an offensively way is generally taught via practice interviews with standardized patients, and this approach may be applicable to assessing the social determinants of health. Didactics and service activities may facilitate the teaching of needed skills. Screening for determinants of health can be incorporated into community-based service learning programs.

The feedback from the student volunteers suggests that undergoing preparatory training, administering the survey, and making community health worker referrals were valued as service-based learning experiences in health disparity intervention. The evaluation of medical students’ learning experiences can provide insights for skills training in undergraduate medical education. Medical students who learn about the social determinants of health through service and formal curricula have been explored in the literature [22,23]. The Health Scholars Program was an immersive 9-month pilot curriculum on the social determinants of health in which medical students and other types of health professional students in Pennsylvania learned through community service, didactics, and critical reflection [20]. Additionally, medical students at the Morehouse School of Medicine in Atlanta, Georgia, participated in a medical-legal, 4-session curriculum that aimed to teach students how to collaborate in medical-legal partnerships to identify and address the social needs of patients in their communities [21]. In both cases, there was a significant pre-post increase in medical students’ desire to screen for social needs [22,23]. There is growing evidence that providing undergraduate medical students with tools for screening and tracking social determinants of health via the EHR acculturates them to the importance of addressing social determinants of health to reduce health disparities [9]. Individual- and community-level social determinants (ie, those tracked in the EHR) have been proposed as vital signs [24]. The EHR infrastructure and a trained and motivated workforce provide the foundation needed to adequately address social needs and reduce health disparities.

Limitations

There are several limitations to this case study. First, the Plan-Do-Study-Act cycle focused on immediate needs and did not address how to integrate social determinants of health screening into the clinical routine. Second, the patient sample size was too small for statistical comparisons. Third, success was defined as a patient being connected with at least 1 social needs resource; therefore, if a patient had more than 1 social need and only 1 was addressed, their encounter was deemed successful, even if their needs were only partially addressed. Fourth, medical students entered social needs screening information into the EHR, and referral data were recorded in REDCap. As such, errors and misclassification bias are possible. Further, some patients may have underreported social needs due to perceived stigma, the sensitive nature of certain topics,
or disclosure concerns, thus raising the possibility of self-report bias. Fifth, the community health worker and some of the medical students involved in this study were not Spanish speakers and needed to use a phone interpreter to interact with Spanish-speaking patients, which could have affected rapport building and the exchange of information. Sixth, the student volunteers represented a little over 5% (11/180, 6.1%) of the average number of enrolled students, and methods for increasing the proportion of medical students who participate in service-based learning for social needs assessment should be considered. Finally, our qualitative data were limited to informal feedback from the medical students, and we did not systematically ask the students, patients, or the community health worker to reflect on the process or the lessons learned. Despite these limitations, our findings may provide useful information that can inform the planning of medical education, health system research, and quality improvement initiatives.

Conclusions
The students developed proficiencies in assessing social needs and documenting their assessments and related referrals in the EHR. In this successful service-based learning experience, preclinical medical students learned how to use community health worker referrals to address social needs. The participating students also gained experience in broaching potentially uncomfortable topics, identifying related needs, and performing the appropriate next steps to address these needs. Since the participating second-year medical students were in preclinical training, this volunteer experience may have been their first exposure to an ambulatory setting and social needs assessment. Opportunities for asking patients about their struggles with social needs can provide a meaningful and memorable experience to medical student trainees. Early practical exposure to social needs assessment has the potential to help medical students develop the ability to address social concerns prior to entering clinical clerkships in the third year of medical school. Finally, medical students gained familiarity with the EHR prior to entering third-year clerkships. Integrating social determinants of health into undergraduate medical curricula could increase the awareness of social needs in the physician workforce, and the integration of the 10-item Social Determinants of Health Screening Questionnaire has resulted in a tool for integrating social needs assessment into clinical practice. Physicians, who are aware of social needs and have the electronic medical record tools and staff resources needed to act, can create workflows to make social needs assessment and services integral components of health care. Larger-scale studies need to assess the effect of integrating screening for social needs and connecting patients to the appropriate social services into routine primary care procedures.

Acknowledgments
The authors gratefully acknowledge the academic guidance from Ellie Schoenbaum, MD (director of medical student research); clinical guidance from Maria Gbur, MD (medical director of the Family Health Center); project implementation support from Reise (Rachel) Sample (Einstein Class of 2022); and project evaluation support from the Harold and Muriel Block Institute for Clinical and Translational Research (project numbers: L2 TR002558, TL1 TR002557, and UL1 TR002556) and the New York Regional Center for Diabetes Translational Research (project number: P30DL111022).

Conflicts of Interest
None declared.

Multimedia Appendix 1
Social determinants of health screening project: preclinical student volunteer training (PowerPoint slides).

[PTX File, 9985 KB - mededu_v8i1e32818_app1.pptx ]

References


16. 4 reasons to take a service year before medical school. Association of American Medical Colleges. URL: https://students-residents.aamc.org/choosing-medical-career/4-reasons-take-service-year-medical-school [accessed 2021-09-06]


**Abbreviations**

AAMC: Association of American Medical Colleges  
EHR: electronic health record  
REDCap: Research Electronic Data Capture
Piloting an Innovative Concept of e–Mental Health and mHealth Workshops With Medical Students Using a Participatory Co-design Approach and App Prototyping: Case Study

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Abstract

Background: Medical students show low levels of e–mental health literacy. Moreover, there is a high prevalence of common mental illnesses among medical students. Mobile health (mHealth) apps can be used to maintain and promote medical students’ well-being. To date, the potential of mHealth apps for promoting mental health among medical students is largely untapped because they seem to lack familiarity with mHealth. In addition, little is known about medical students’ preferences regarding mHealth apps for mental health promotion. There is a need for guidance on how to promote competence-based learning on mHealth apps in medical education.

Objective: The aim of this case study is to pilot an innovative concept for an educative workshop following a participatory co-design approach and to explore medical students’ preferences and ideas for mHealth apps through the design of a hypothetical prototype.

Methods: We conducted a face-to-face co-design workshop within an elective subject with 26 participants enrolled at a medical school in Germany on 5 consecutive days in early March 2020. The aim of the workshop was to apply the knowledge acquired from the lessons on e–mental health and mHealth app development. Activities during the workshop included group work, plenary discussions, storyboarding, developing personas (prototypical users), and designing prototypes of mHealth apps. The workshop was documented in written and digitalized form with the students’ permission.

Results: The participants’ feedback suggests that the co-design workshop was well-received. The medical students presented a variety of ideas for the design of mHealth apps. Among the common themes that all groups highlighted in their prototypes were personalization, data security, and the importance of scientific evaluation.

Conclusions: Overall, this case study indicates the feasibility and acceptance of a participatory design workshop for medical students. The students made suggestions for improvements at future workshops (eg, use of free prototype software, shift to e-learning, and more time for group work). Our results can be (and have already been) used as a starting point for future co-design workshops to promote competence-based collaborative learning on digital health topics in medical education.

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KEYWORDS
participatory design; co-design; mHealth; medical student; eHealth; medical education; mental health; mobile phone
Introduction

Background: Medical Students and the Potential of Mobile Health Apps

Medical students’ poor mental health remains a worldwide challenge. Despite the high prevalence of mental illness among medical students [1], they are less likely to seek help than age-matched controls [2]. Moreover, they encounter additional hurdles when seeking help, such as fear of stigmatization or disadvantages for their prospective career [2-4]. Thus, face-to-face counseling on campus might not be the appropriate option for all students. Mobile health (mHealth) apps could help reduce the treatment gap.

Previous research suggests that digital interventions can be an effective tool to promote university students’ mental health [5]. They address several barriers such as fear of stigmatization and provide help independently of time and location [6-8]. Especially in the face of the ongoing COVID-19 pandemic, digital access to psychological support is more important than ever [9]. However, the uptake of suitable mHealth apps among college students remains relatively low [10,11]. Evidence of acceptance of mHealth apps, including mental health apps, among university students is still limited and inconclusive [5,12,13], especially regarding the subgroup of medical students [14].

A possible explanation for the low uptake of mHealth apps might be that existing mHealth apps do not reflect medical students’ needs and preferences [15]. Understanding users’ needs might help to increase the early acceptance and use of mHealth apps [16]. A further reason for the low uptake might be that medical students lack familiarity with mHealth apps. For instance, in a recent study, only 1.3% of the participating German medical and psychology students reported ever having used an mHealth app [15]. Moreover, medical students’ understanding of several aspects concerning mHealth apps (eg, terminology) is limited [17-20]. This knowledge is of great relevance for medical students, from both user and health care provider perspective. In December 2019, the German government passed the Digital Healthcare Act, which allows for the prescription of medical apps, including mental health apps [21]. As future health care providers, medical students will influence digital health care by prescribing mHealth apps to their patients [15]. Thus, they play a key role in facilitating the awareness and acceptance of mHealth apps in the general population. However, education on e–mental health and mHealth is still rare in medical curricula in Germany [22] as well as the rest of the world [23,24].

Given the relevance of the subject, educational concepts are needed to help implement mHealth in the medical curriculum.

Goals of This Case Study

The primary aim of this case study is to describe the piloting of a novel co-design workshop on mHealth and e–mental Health at a German medical school. We sought to explore the feasibility of co-design workshops as an educational concept and asked for participants’ evaluations and suggestions for improvements regarding future co-design workshops (iterative development). Furthermore, we were interested in medical students’ ideas and preferences for prototypes of mHealth apps and their application of the theoretical insights conveyed during the workshop.

Methods

Participants and Setting

The participants in this case study were preclinical and clinical medical students enrolled at the medical school of Heinrich Heine University Düsseldorf (HHU) in Germany. The inclusion criteria were age ≥18 years and registration for the elective course e–Mental Health in Medical Education (ie, the co-design workshop). Participation in this study was voluntary and did not affect the successful completion of the course. All participants gave their informed consent and agreed that their data (eg, their feedback and ideas for mHealth apps) could be used for research purposes. The study was approved by the ethical committee of the medical faculty of the University of Düsseldorf as part of a medical education project called Healthy Learning in Düsseldorf, which aims to investigate and improve medical students’ mental health (study number: 4041).

The Co-design Workshop

We conducted the co-design workshop on 5 consecutive days on site from March 2 to 6, 2020, at the Faculty of Medicine at HHU, approximately 1 week before the first COVID-19 lockdown [25] and approximately 7 months before the directory for prescriptible digital health apps (Verzeichnis für digitale Gesundheitsanwendungen or Digital Health Applications Directory) was thrown open to the public in Germany [26]. The duration of the workshop was 30 hours in total, delivered over 5 days (11 AM to 5 PM from Monday to Friday), and it was held during the semester holidays. The workshop comprised lectures and supervised group work. Each day was designated for a specific topic or method of intervention development with respect to e–mental health (including participatory design approaches). Different modules guided the students through the development of a rapid prototype of their own mental health app (Table 1). In all, 3 guest lecturers were involved on days 2-4 to give insights into the development of mHealth apps. We conducted focus groups on the second and third day, which have been reported elsewhere [27].

Generally, each day of the workshop was structured in 2 parts. The first part consisted of introductory lectures on eHealth and participatory design methods. Moreover, the students were shown how to identify existing mHealth apps that are safe to use and are also of high quality. During the second part, the participants were divided into smaller groups to work through relevant literature on e–mental health and to develop their own hypothetical prototype for a mental health intervention. For this, they used a range of methods grounded in participatory design, design thinking, and target population–centered approaches to intervention development (Table 1). The students could create the concept for a native app or a web-based app (web version optimized for smartphone screens). They were asked to implement and consider everything that they deemed important.
Table 1. Workshop contents.

<table>
<thead>
<tr>
<th>Workshop day</th>
<th>Educational content</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction, components and types of guidance for mHealth(^a) apps, quality criteria for mHealth apps, and legal framework</td>
<td>Introductory lecture, group work, presentations and plenary discussions on relevant literature, legal aspects, and identification of existing mHealth apps that are safe to use and are also of high quality (MARS-G(^b)) [28]</td>
</tr>
<tr>
<td>2</td>
<td>Acceptability and user orientation, co-design and participatory design methods, and strategies and model for designing mHealth apps</td>
<td>Expert lecture (building your own mHealth app and insights into a medical student’s back pain app start-up), focus groups part 1 (reported elsewhere [27]), participatory approaches: think-aloud technique, and IDEAS(^c) [29]</td>
</tr>
<tr>
<td>3</td>
<td>Gamification, development and adjustment of mHealth apps, and avatars</td>
<td>Expert lecture (assessment of avatar of a certified medical app for insomnia, Somnio), storyboarding, focus groups part 2 (reported elsewhere [27]), and prototyping avatars in groups</td>
</tr>
<tr>
<td>4</td>
<td>Acceptance-facilitating interventions, adherence-facilitation, and implementation</td>
<td>Expert lecture (web-based marketing), persona development, journey mapping, implementation mapping, prototyping, development of personas in groups, and mock-ups and prototypes</td>
</tr>
<tr>
<td>5</td>
<td>Presentations and workshop evaluation</td>
<td>Presentations of the mHealth app concepts, feedback questionnaires, and feedback round</td>
</tr>
</tbody>
</table>

\(^a\)mHealth: mobile health.  
\(^b\)MARS-G: Mobile App Rating Scale, German version.  
\(^c\)IDEAS: Integrate, Design, Assess, and Share.

The first author (MD) and the last author (JAH) facilitated the workshop. JAH created the contents of the workshop with the support of MD. MD is a researcher and trained psychologist. JAH is a qualified psychologist with a background in medical psychology and an experienced researcher with focus on e–mental health and mHealth acceptance in different target groups, including medical students, as well as psychosocial stress research. Both facilitators conduct lectures for medical students and are involved in research on medical students’ well-being. They took turns conducting lectures; the other observed and took field notes.

**Prototypes of Apps: Knowledge Transfer**

Each group, consisting of 3-7 students, focused on a different psychological problem for their hypothetical prototype of an mHealth app. Participants could choose from among the following 5 predetermined group topics, selected on the basis of their relevance for promoting mental health among medical students [1,30-32]:

- Depression and anxiety (transdiagnostic; students chose to focus on depressive symptoms)
- Stress management and subjective well-being
- Test anxiety and procrastination
- Insomnia (focus on health behavior and sleep quality)
- Psychosomatic conditions (self-management of chronic conditions; students chose to focus on gastrointestinal problems)

The medical students also had the opportunity to adapt their topic or propose other health conditions. All groups were supervised and provided with feedback during the development phase of their mHealth app.

**Data Collection and Descriptive Analysis**

During the workshop, the facilitators took notes and documented the workshop with photographs. All written and designed material was collected with the permission of the participants. In addition, the participants filled out a so-called logbook with predefined tasks mirroring the contents of the workshop. The logbook was also used to document their thoughts, ideas, and progress regarding the development of their prototype. The final segment of the workshop was devoted to the group presentations of the hypothetical app concepts. The presentations were rated based on predefined evaluation criteria (Textbox 1). The groups could choose to present their hypothetical prototypes using either a digital or flip chart presentation format. Of the 5 groups, 4 (80%) chose a digital presentation format. The presentations were analyzed, where possible, based on the extended version of the Unified Theory of Acceptance and Use of Technology, (UTAUT2 [33]) which has been introduced in the workshop. UTAUT2 has been postulated as a framework to understand and predict technology uptake and use. The model comprises 4 constructs from the original model (effort expectancy, facilitating conditions, performance expectancy, and social influence [34]) as well as 3 additional constructs (habit, hedonic motivation, and price value). The UTAUT2 model has been used in different contexts such as acceptance of electronic medical records or mobile learning technology [35-39]. Here, for instance, we looked at whether the medical students’ prototypes included elements that foster hedonic motivation, such as gamification (Textbox 1). In some cases, we needed to extend the categories inductively based on the material because UTAUT2 did not provide a suitable category such as data security.
Criteria for the evaluation of medical students’ presentations on their prototypes of mobile health apps.

<table>
<thead>
<tr>
<th>Evaluation criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of the content</td>
</tr>
<tr>
<td>Relevance for the target group and field of action</td>
</tr>
<tr>
<td>Overall concept and presentation: comprehensibility, rationale, and logic</td>
</tr>
<tr>
<td>Selection of content and components (based on evidence, empiricism, etc)</td>
</tr>
<tr>
<td>Practical transfer: strategies for dissemination and execution</td>
</tr>
<tr>
<td>Implementation</td>
</tr>
<tr>
<td>Manner of presentation</td>
</tr>
<tr>
<td>Visualization</td>
</tr>
</tbody>
</table>

At the end of the workshop, the participants completed a brief feedback questionnaire to evaluate the workshop. They were asked 3 questions regarding their perceived learning progress during the workshop on a scale from 1 (strongly disagree) to 6 (strongly agree), and they were given the opportunity to add suggestions for improvement in free text. In addition, feedback was collected during an oral feedback round and within a standardized anonymized evaluation form for lectures at medical schools. The latter is not reported in this study. The participants’ feedback was used to make alterations and improvements for future workshops. Statistical analysis of the paper-based questionnaire data was performed using the software SPSS (version 25.0; IBM Corp).

Results

Sample Characteristics

In all, 26 participants (women: 17/26, 65%; men: 9/26, 35%) aged 18-30 years (mean 23.35, SD 3.73 years) took part in the workshop. All participants were medical students from the third to the ninth semester (mean 4.31, SD 1.87) at HHU. Of the 26 students, 16 (62%) were in their third semester, 4 (15%) were in their fifth semester, 5 (19%) were in their seventh semester, and 1 (4%) was in their ninth semester (median third semester). All (26/26, 100%) participants attended on all 5 days of the workshop and completed the course with a group presentation of their app concepts and prototypes (ie, there were no dropouts). The participants gave permission to use their intellectual work and feedback for research and publication purposes.

Common Themes: Narrative Insights From the Group Discussions and Group Work on the App Development

The common themes described in Textbox 2 have been derived either directly from the prototypes or have been identified in plenary discussions. Of the 5 groups, 4 (80%) did not include specific features for medical students in their designs. The main reason for this, the students stated, was that they did not want to be seen as an exclusive target group but rather as students in general. However, they implemented some aspects that are typical of students or people working in health care (eg, shift work). Especially, customizations addressing students’ needs in general (eg, low income, high workload, and irregular schedule) were considered essential. Accordingly, it was important to the students that their app should be provided to university students free of cost. Most groups also offered a variety of ways to customize the app. For instance, push notifications could be scheduled to match users’ preferences or be completely turned off. These customizations were believed to provide a more pleasant user experience and facilitate the daily use of the mHealth app, which was seen as a prerequisite for its success. Moreover, the students considered it important that their app should be easy and intuitive to use for a broad range of users, a reason for this being that medical students have a comprehensive schedule and are not willing to invest a lot of time getting acquainted with an mHealth app. All prototypes included some elements of gamification. In all, 2 aspects stood out because they were repeatedly highlighted by all the groups: data security and evidence base. The students in the workshop considered mental health to be a sensitive topic that should be treated confidentially. The students also seemed to have concerns regarding big data: they generally did not approve of companies storing or even selling their data and considered this to be a no-go area for an mHealth app. Furthermore, they stated that they would only trust an mHealth app that had been tested and approved by a trustworthy source (eg, their university) and was supported by scientific research.

The students also discussed strategies to improve the uptake of novel e–mental health services such as advertisements using testimonials, including potential negative effects of testimonials. They expressed skepticism regarding such testimonials, especially when they exclusively involve positive ratings. Rather, they preferred balanced reviews (including positive and negative aspects) by trusted sources. Taken together, this points to the need to include user target groups in the design process of mHealth apps to increase their acceptance and use.
Textbox 2. Common themes among all groups during prototyping.

<table>
<thead>
<tr>
<th>Common themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• On the basis of scientific evidence</td>
</tr>
<tr>
<td>• Certification</td>
</tr>
<tr>
<td>• Transparent quality criteria</td>
</tr>
<tr>
<td>• Free of cost or cost reimbursement</td>
</tr>
<tr>
<td>• Personalization</td>
</tr>
<tr>
<td>• Gamification (limited and not too playful)</td>
</tr>
<tr>
<td>• Easy and intuitive handling</td>
</tr>
<tr>
<td>• Daily use or daily commitment (eg, reminders)</td>
</tr>
</tbody>
</table>

Case Illustrations: App Development

In this section, the hypothetical prototypes developed by 40% (2/5) of the groups will be presented as exemplary concepts. The 2 prototypes in this paper were chosen based on their visual clarity and comprehensive concept. All creative theoretical work and design samples belong to the students and cannot be used without their permission.

Textbox 3. App concept for Moodly.

Moodly: app concept

• Moodly would be accessible as both mobile app and web-based program. The students stated that the goal of the app is to decrease depressive symptoms, impart positive impulses for the day (eg, recommendations for positive activities), and provide guidance to better deal with negative emotions and thoughts (eg, using relaxation exercises). Moreover, it aims to give users a daily structure, improve self-efficacy, and create awareness of their emotions and thoughts.

• The target group consists of not only medical students but also students in general who display depressive symptoms or are experiencing a mild depressive episode (ie, early intervention as the first step or additional support). Users are encouraged to seek professional support; the app informs them that it is not a substitute for treatment.

• The app includes elements of gamification, including personalization, reminders to use the diary, and motivating messages. To increase adherence and use in the long run, users can adapt the app design to their needs and preferences. They can use emojis, upload a picture, or include Graphics Interchange Format files and stickers when making a diary entry. Moreover, the app is structured in a specific order. When students complete a level, they receive a level up notification (progress and rewards).

• The students described the design as colorful and esthetic. Users can create a profile and chat and interact with other users. Furthermore, the app provides a variety of helpful videos and resources, for example, to deliver psychoeducation. Therapists and scientists will verify all content in the app. The students highlighted that the app is easy and intuitive to use.

• As the students were worried about people who use the app having an acute mental health crisis, an emergency help button is included in every screen (Figures 2-7). If users tap the button, a screen opens through which users can directly contact the German suicide prevention hotline or chat with a psychologist from the app itself (Figure 4). These psychologists are professionally trained in first-line psychotherapy approaches such as cognitive behavioral therapy.

• Before the app is launched in app stores, all students from Heinrich Heine University Düsseldorf would have the opportunity to test it. If they approve it, this can be extended to other universities. Finally, students could provide testimonials for the app in diverse app stores. The entire process would be monitored and assessed by scientists at Heinrich Heine University Düsseldorf.

• Another major concern highlighted by the group presenting Moodly was data security. Moodly would be strictly anonymous; only admins and therapists available on the app would have access to a user’s email address in case of emergency (eg, suicidal thoughts). Terms of use would be communicated transparently and be easy to understand.

• The app should be used daily.
Figure 1. Logo of the app Moodly.

Figure 2. Mock-up of the app Moodly: users are asked whether they want to answer questions to personalize the app.
Figure 3. Mock-up of the app Moodly: menu and home screen.

Figure 4. Mock-up of the app Moodly: emergency help screen.
**Figure 5.** Mock-up of the app *Moodly*: diary.

**Figure 6.** Mock-up of the app *Moodly*: mood rating.
• Dreamy Pug (an mHealth app for insomnia; Figures 8-19): a group of 3 students (n=2, 67% were women, and n=1, 33% was a man) developed the concept for the insomnia app Dreamy Pug. In Textbox 4, the app is described in the form it would have taken had it been programmed and implemented.

Figure 7. Mock-up of the app Moodly: mood tracker.

Figure 8. Logo of the app Dreamy Pug.

**Dreamy Pug: app concept**

- The students designed this mobile app for people with insomnia who want to improve their sleep quality.
- Before the first use, users can answer questions (eg, about their age; Figure 15) to receive tailored suggestions on sleep behavior.
- The app is not specially targeted at medical students but rather created for people working in shifts (eg, hospital staff) as they face additional challenges because of their irregular sleep schedule. The app is also suitable for students who often study and sleep in the same place (studio apartment) and face multiple distractions because of their extensive use of smartphones and other electronic devices.
- In case of severe insomnia, users receive an alert to seek help from a professional.
- **Dreamy Pug** aims to increase sleep duration and quality. Moreover, it offers psychoeducation to improve users’ knowledge and understanding of insomnia and the lifestyle and health behavior factors that influence it. This includes exercises to help users fall asleep or for relaxation (eg, progressive muscle relaxation) as well as tips for better sleep hygiene and environment control. All exercises and tips in the app are based on scientific evidence and reflect guidelines from medical societies.
- The avatar **Dreamy the Pug** guides users through the app, explaining its functions. Handling and language of the app have been made as understandable as possible. The app monitors duration and quality of sleep. These data then help to personalize the app to users’ needs and habits.
- Wearables can be connected to the app to improve the quality of sleep tracking. If a user wakes up during sleep, the app recognizes this and immediately offers them help to go back to sleep. In addition, the app can restrict the use of other apps during the time users want to sleep (eg, social media apps). The students stated from personal experience that when they use these apps during the night, going back to sleep becomes harder.
- Further personalization of the app is possible, such as the regulation of push notifications. The app has 3 main modes for night, morning, and day (Figures 11-13). Design and luminosity vary within these modes.
- The group that designed **Dreamy Pug** pointed out that it would be provided free of cost to students after it has been certified and tested in scientific trials.
- The app includes several elements of gamification. The mechanism behind points and rewards is positive reinforcement. If users sleep well, they gain points that they can use to unlock new characters (eg, **Sleepy Fox**) or new sets of blankets for **Dreamy the Pug**.
- Users can also track their progress (Figure 19). In this section, statistics on sleep duration are depicted.
- The app should be used on a daily basis to ensure a reliable sleep profile.

Figure 9. Mock-up of the app **Dreamy Pug**: storyboarding and first draft.
Figure 10. Mock-up of the app *Dreamy Pug*: Dreamy the Pug, the avatar.

Figure 11. Mock-up of the app *Dreamy Pug*: Screen adapts to different times of the day (here: Night screen).
**Figure 12.** Mock-up of the app Dreamy Pug: Screen adapts to different times of the day (here: Morning screen).

**Figure 13.** Mock-up of the app Dreamy Pug: Screen adapts to different times of the day (here: Evening screen).
Figure 14. Mock-up of the app *Dreamy Pug*: welcome screen.

Figure 15. Mock-up of the app *Dreamy Pug*: assessment of personal data (here: age).
Figure 16. Mock-up of the app *Dreamy Pug*: menu from which to choose different exercises.

Figure 17. Mock-up of the app *Dreamy Pug*: nightly intervention after user woke up during sleep.
Workshop Evaluation and Suggestions for Improvement

The feedback from participants upon workshop completion showed that, among other things, it was well-received. The students showed great interest in the presented contents, including the acquisition of knowledge about quality-approved e–mental health solutions. In addition, the students emphasized the benefits of involving potential users in app development. However, the face-to-face workshop was seen to be in need of improvement. The students requested more self-learning components and web-based tools as well as more opportunities to test e–mental health solutions. Moreover, they suggested including more group work, individual work, and interactions in terms of mutual exchange of ideas and exercises of practical relevance. By expanding the digital elective components, the
elective course could also be better integrated into everyday life and thus increase the learning effect (self-directed learning and e-learning).

The feedback questionnaire suggests that most of the students were not familiar with e-mental health before the workshop (Table 2). Of the 26 students, 22 (85%) somewhat disagreed, disagreed, or strongly disagreed that they already knew a lot about the learning contents provided at the workshop (mean 2.38, SD 1.10; equals somewhat disagree). Of the 26 students, only 1 (4%) agreed that they were familiar with e-mental health before the workshop; 21 (81%) somewhat agreed, agreed, or strongly agreed that they had learned many new things (mean 4.58, SD 1.10; equals agree); and 17 (65%) somewhat agreed, agreed, or strongly agreed that they had learned valuable content for their future practice as physicians (mean 3.77, SD 1.24; equals somewhat agree).

Students suggested the following improvements in the free-text questions of the feedback questionnaire: learning more about existing apps, testing specific apps, and learning more about app design and technical implementation (“What is needed to create a good app?”).

Table 2. Workshop evaluation (scale from 1=strongly disagree to 6=strongly agree).

<table>
<thead>
<tr>
<th>Question</th>
<th>Values, mean (SD)</th>
<th>Values, median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Before the workshop, I already knew a lot about the topics covered in the workshop”</td>
<td>2.38 (1.10)</td>
<td>2 (1.25)</td>
</tr>
<tr>
<td>“I learned a lot of new things in the workshop”</td>
<td>4.58 (1.10)</td>
<td>4.5 (2)</td>
</tr>
<tr>
<td>“I have learned a lot of useful things for my profession”</td>
<td>3.77 (1.24)</td>
<td>4 (2)</td>
</tr>
</tbody>
</table>

Discussion

Principal Findings

The aim of this study is to describe an innovative concept for an educative workshop following a participatory co-design approach. Moreover, we wanted to present samples of medical students’ prototypes and ideas for mHealth apps, highlighting their preferences and needs.

The co-design workshop was well-received by medical students. It created an environment that allowed participants to engage and be creative from both user and prospective health care provider perspective. The small groups ensured that all participants were able to engage in the design process, as suggested in previous research [40,41].

Moreover, the students provided insights into how mHealth apps can be designed to meet their needs: they agreed that it would be beneficial if the app considered challenges that are specific for shift workers and students in general. Throughout all groups, one of the main issues highlighted by participants was data security provided by their app. This finding fits into the international literature, where data protection concerns have been identified as a key barrier for the adoption of eHealth across various target groups [42].

Confidentiality was another related topic relevant for medical students, especially because many mental health apps do not fulfill this criterion [43,44]. This is interesting to note, considering that stigmatization of mental illness is still prevalent in the medical field, and especially students fear professional disadvantages from the disclosure of a mental health problem [2,45]. It is important that mHealth apps provided for medical students are approved by trustworthy sources such as the students’ university [27]. Similarly, students perceived the app being tested in scientific trials and receiving certification for its effectiveness as an indicator of app quality. Furthermore, the students suggested that information regarding the evidence base, including references to randomized controlled trials, should be integrated into the app’s description to support informed decisions. Further information on the provider or on data security should be included in the app’s terms and conditions section.

In addition, the participants declared customizable elements, easy and flexible use, and daily commitment as essential during the presentation of their mHealth app prototypes. This is in line with the principles of persuasive design, which has also gained importance in the health informatics educational sector in recent years [46]. All groups included elements of gamification in their apps, which is in line with the determinant hedonic motivation in the UTAUT2 model [33] and aims to foster user engagement, motivation, and adherence [47]. Moreover, gamification might improve the learning process in health education [48].

However, the students were critical of parts of the lectures on mHealth apps because they had difficulty following them on an abstract level without an mHealth app for practical demonstration. This was due to the limited availability of freely accessible quality-approved mHealth apps, which has been acknowledged as a barrier in previous mHealth educational research with medical students [24]. Hence, future educational workshops should preselect suitable mHealth apps and provide them to students in the workshop.

Interestingly, the group discussions and prototypes developed in this workshop suggest that most medical students do not see an urgent need for mHealth apps directly targeted at medical students [27]. Only specific features for students (eg, low income, high workload, and exam-related distress) or people working in health care (eg, shift work) were proposed.

Several quality-approved, effective digital mental health interventions for students exist [5,49], but they are not well known or used by medical students. Therefore, the key challenge is to reach medical students. This could be achieved with targeted information or through specific channels (eg, student support groups and mentoring [49]). However, medical students may not be particularly interested in apps that are exclusively designed for them; rather, they might be interested in apps that are designed for students in general. Medical students are at
Lessons Learned

The suggestions received at this pilot workshop have been transferred to a novel e-learning participatory design workshop with medical students. It was conducted for the first time in the 2021 summer semester (e–mental health literacy as an elective subject, with support of the Medical Faculty Quality Funds for innovative educational projects). A novelty of the new e-learning workshop on e–mental health and mHealth for medical students is that it offers an extensive e-learning module on the quality criteria of mHealth apps as well as new ways of implementing remote group work (under continuous guidance by the team of educators), and their integration into routine care, design thinking, and gamification. This helps to systematically guide small groups of medical students through the design of a prototype mHealth app, alongside engaging sessions and continuous tailored feedback. The platforms used are ILIAS (an open-source digital learning platform for asynchronous self-directed learning), Webex (Cisco Systems, Inc), and Microsoft Teams (videoconference-based live synchronous meetings and collaborative learning), as well as free prototyping software. On the basis of the students’ feedback, the workshop will be iteratively refined using participatory design approaches. Thus, the subsequent workshop included new educational content of more practical relevance for medical students, such as the prescription of apps. Moreover, the switch to e-learning seems to have facilitated knowledge acquisition significantly: the second workshop was evaluated more positively compared with the pilot workshop, and knowledge acquisition was rated consistently as high. Future workshops could also include objective tests regarding the improvement of eHealth literacy, for example, through a quiz at the start and the end of the workshop (pre–post design). However, for us, it was primarily important to learn whether students deem the workshops to be valuable as an educational tool and which aspects need to be adopted for future workshops.

Upon completion of the quality-improvement project, the participatory workshop will be implemented as a standard elective subject in the medical curriculum at HHU. The curriculum will likely be extended to other fields in eHealth as well, such as digital health for chronic conditions. Moreover, a collaboration with the university’s computer science department is planned that could offer the opportunity to translate medical students’ ideas into actual mHealth apps. This case study lays the foundation for these ambitions by exploring medical students’ perspective in detail, providing concept sketches, and initiating communication channels.

Limitations

The exploratory nature of our case report entails several limitations that must be considered. First, our results concerning medical students’ ideas and preferences for mHealth apps are not conclusively generalizable to the entire medical student population. Rather, this case study offers subjective insights into participatory workshops for educational purposes from the educators’ perspective.

A second concern related to generalizability is that participants chose the workshop as an elective course. Thus, there might be a self-selection bias if especially students familiar with, or interested in, mHealth attended the workshop. Students with no interest in mHealth could have had other ideas or preferences compared with those of the workshop participants. However, the students indicated low familiarity with eHealth, and many chose the workshop as an elective course because it was held on 5 consecutive days during the semester holidays.

Third, all participants were regular smartphone users as well as digital natives and therefore widely familiar with smartphone apps. It became evident on different occasions (eg, in group discussions and feedback rounds) that they had already formed critical opinions on related topics (eg, big data) before the workshop. This might be why they highlighted the importance of data security.

Furthermore, it is likely that the different lectures, exercises, and tasks throughout the workshop (eg, creating avatars and personas as well as learning about mHealth guidelines) influenced the students’ prototypes. However, they only included elements that they perceived as useful for their prototype (eg, no avatar in Moodly).
Finally, the workshop was conducted in Germany where digital health is not yet a mandatory or widespread part of medical education [22]. However, it is important to note that medical schools in many countries worldwide have already recognized the urgent need to implement eHealth in the curriculum. The rate of progress in the digitalization of health care has increased, especially since 2020, for instance, in Switzerland [56]. A next step for German medical schools would be to integrate digital competencies in the NKLM (Nationaler Kompetenzbasierter Lernzielkatalog Medizin or National Competence-Based Learning Goal Catalog for Medicine) accordingly [22,57].

Implications and Recommendations

For Researchers

Researchers might consider the following implications and recommendations:

- Develop an empirical and theory-led guide for best practice through continuous evaluation of medical students’ preferences and needs using both qualitative and quantitative research methods.
- Define and test outcomes of the learning success by combining subjective and objective measures based on digital health technology literacy frameworks [58]. However, note that there is a lack of randomized controlled trials in the field because workshops within elective subjects pose organizational and ethical challenges for this particular study design [59].
- Enable the cocreation of educational content using participatory research approaches (eg, person-based approach [60]).

For Lecturers

Lecturers might consider the following implications and recommendations:

- Define a set of clear competencies and learning goals that should be obtained through the workshop [55].
- Provide personalized and interactive digital learning platforms in line with recent trends [55].
- Select and use novel educational tools and web-based platforms such as Psy-Q [61].
- Learn how to create apps—easy and intuitive software tools to build initial apps exist (eg, iBuildApp [62]).
- Encourage the collaboration of physicians and informatics experts as lecturers, for example, as shown in the DigiWissMed project in Germany [63].
- Offer trainings in digital health for medical educators.

For Medical Schools

Medical schools might consider the following implications and recommendations:

- Note that in Germany, most eHealth-related topics are taught within elective subjects, and the number of such courses is very limited [22]. Usually, these existing eHealth courses in Germany do not consider mental health as a relevant topic for medical students as potential users and future physicians. Hence, there is a need not only for eHealth education in general, but also for digital mental health in particular. Surveys could help to determine the needs and preferences of medical students regarding the implementation of eHealth in the curriculum.
- Note that not all medical students may be interested in eHealth or in creating their own apps in the same way. Thus, basic knowledge on eHealth could be implemented in the standard curriculum, whereas more advanced or in-depth courses could continue to be part of the elective curriculum [64].

Conclusions

Overall, the participatory workshop on e–mental health was well-received by medical students. Thus, it seems to be a feasible approach that can be used as a starting point for future educational activities with medical students. Moreover, the medical students had a clear vision for their ideal mHealth apps after being informed about key quality criteria and persuasive design features. As medical students are both potential users and future health care providers, the adoption of mHealth education into the medical curriculum should be considered.

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Conflicts of Interest

None declared.

References


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Abbreviations

HHU: Heinrich Heine University Düsseldorf
mHealth: mobile health
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