SANG-WHA SIEN, University of British Columbia, Canada JESSICA Y. AHN, University of British Columbia, Canada JOANNA MCGRENERE, University of British Columbia, Canada

Mental health problems are a serious concern among university students, and international students in Canada are known to be particularly vulnerable due to the underutilization of mental health services and unfamiliarity with Western approaches to mental health. However, international students' mental well-being remains underexplored in HCI. In this study, we conducted remote synchronous remote co-design sessions with 19 participants (14 international students, 5 mental health professionals) to understand concretely what types of designs for interactive technologies suit these students' mental health needs and challenges. Based on their brainstormed ideas and sketches, we produced a set of design dimensions that span different types of support, interaction, and safety. The dimensions were then used to develop a set of four medium-fidelity mockups that spanned these dimensions, presenting a diverse range of design features. Using these mockups, we elicited feedback in an online survey from the same participants. Findings suggest that the students negotiate a complex understanding of helpfulness, comfort, and trust when they consider what types of designs to consider using. Each mockup highlights different ways to support individual differences and preferences. Our work serves as a foundation for designing technologies that can ease issues with accessibility and be more inclusive of international students' cultural backgrounds.

CCS Concepts: • Human-centered computing  $\rightarrow$  Empirical studies in collaborative and social computing; *Ethnographic studies*; • Social and professional topics  $\rightarrow$  *Race and ethnicity.* 

Additional Key Words and Phrases: mental health; international students; university students; co-design; storyboards; design dimensions; collaborative personas

#### **ACM Reference Format:**

Sang-Wha Sien, Jessica Y. Ahn, and Joanna McGrenere. 2023. Co-designing Mental Health Technologies with International University Students in Canada. *Proc. ACM Hum.-Comput. Interact.* 7, CSCW2, Article 258 (October 2023), 25 pages. https://doi.org/10.1145/3610049

## **1 INTRODUCTION**

Mental health concerns have become an increasingly serious issue among university students [4, 5]. As emerging adults, they are at an age when they are at greater risk for mental health distress than the general population [1, 13], impacting goals for education, career, and both social and personal development [47]. Research has shown that international students, a diverse group with different ethnic and cultural backgrounds, are particularly vulnerable due to their experiences transitioning to a different country. This is especially the case for those with non-Western backgrounds. They experience several stressors such as language barriers, discrimination, homesickness, social isolation,

Authors' addresses: Sang-Wha Sien, University of British Columbia, Vancouver, Canada, swsien@cs.ubc.ca; Jessica Y. Ahn, University of British Columbia, Vancouver, Canada, yoojin.ahn@mail.mcgill.ca; Joanna McGrenere, University of British Columbia, Vancouver, Canada, joanna@cs.ubc.ca.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.

© 2023 Copyright held by the owner/author(s). Publication rights licensed to ACM.

and difficulty navigating cultural differences as they adapt to their host country's culture [27, 56, 61, 65]. Compounding these challenges are reports that international students seek counseling and other mental health services at lower rates than their domestic counterparts and generally have more negative attitudes and stigma towards seeking treatment, in part due to less familiarity with Western approaches to mental health [23, 38].

In Human Computer Interaction (HCI), there has been increasing interest in the role of technology in the mental health of students and young adults. More specifically, there has been a growing awareness of the need to investigate the well-being of those who do not align with the dominant Western understanding of mental health, such as international students [27, 57, 61] and those from developing countries [48, 66]. This is synergistic with multicultural guidelines from counseling research and practice which advocate for inclusive treatment and outreach [15, 19, 41]. In one study, Tang [61] considered the health-seeking pathways of international students, noting that they encounter difficulties accessing and adopting health services, including those for mental health. This accessibility issue is also reflected in our previous findings [57] that found that East Asian university students in Canada face significant barriers to entry when it comes to using technologies for mental health due to cultural stigma. Despite the seriousness of these findings, the mental health of international students remains underexplored in HCI, to the extent that some researchers have begun to call them a "hidden" [33] or "overlooked" minority [12]. Our research aims to address this gap by examining international students' perspectives on mental health technologies.

In this study, we wanted to understand students' mental health within the context of the holistic influences of campus life, including students' social networks and interactions with campus personnel and services. Recent studies in HCI have explored this broader context by leveraging the use of ecological frameworks [30, 46, 60, 63]. This reflects the increasing emphasis that research has placed on the importance of social support and the settings in which it occurs, as it is crucial for establishing greater resilience and health among students [20, 35, 45, 52]. We take inspiration from prior work [30, 40, 46, 60, 63] by framing our study with a socially ecological perspective to holistically understand how students navigate cultural expectations and different social groups and settings (namely, campus personnel, services) to explore designs for mental health.

We address the following two research questions: 1) How do international students and campus student-wellness professionals envision how technology can help the students' mental health? 2) Which designs could be helpful for international students to access the services and support they need for their mental health concerns? To answer these questions, we recruited 19 international students and campus student-wellness professionals at a large Canadian university. Our goal was to identify how mental health technologies could be designed to be more accessible to international students. We chose a participatory design approach for this study as it allowed the students to directly share their perspectives.

This study was broadly divided into four stages. Stage 1 consisted of participants individually coming up with a persona. Stage 2 consisted of the co-design sessions. In each session, we collaboratively developed one persona to use as the basis of the brainstorming and sketching exercises. In Stage 3, based on the exercises, we developed a set of design dimensions and four different medium-fidelity mockups that covered a diverse range of these dimensions. And finally, in Stage 4, these mockups were used as elicitation probes in an online survey to gather open-ended feedback from the same participants regarding their interest in using these designs in their day-to-day lives.

This study contributes to the body of research on the mental health of university students in several ways. First, we provide a method for collaborative development of personas, including the use of Activity Cards, which was shown to help our participants talk about mental health more comfortably and readily. Second, we provide empirical findings from the co-design sessions which we used to develop a set of design dimensions. These dimensions include types of support,

interactions, and safety. Lastly, we provide empirical findings elicited from our medium-fidelity mockups, showing that international students negotiate helpfulness, comfort, and trust when they consider what types of mental health digital technologies they want to use.

Our findings and subsequent discussion serve as a foundation for designing technologies that are more inclusive of those with different backgrounds who may not be familiar with Western understandings of mental health and the narratives surrounding it. We discuss ways that digital technology can ease issues with accessibility and adoption of mental health services among this "overlooked" minority.

#### 2 BACKGROUND AND RELATED WORK

This research adds to the body of work in HCI focusing on the use and design of technology for university students' mental health. We first present background on the mental health of this target population and then cover how HCI has framed research and envisioned designs to support them.

#### 2.1 Mental Health of University Students

Recent statistics show that Canadian university students have reported high rates of overwhelming anxiety (68.9%), above-average stress (60.9%), and depression (51.6%) [5]. This is not surprising, given that the time spent in university is one full of uncertainty and instability as they experience personal, career, and educational transitions [3, 32, 43]. Many universities have planned and implemented resources and services to address student mental health, such as counseling services and educational materials. Yet, worryingly, they are used primarily as emergency treatment by students and are thus underutilized [10, 36]. Researchers in HCI have endeavored to better understand and design effective interventions by investigating the role of software applications in tracking behaviors and supporting self-help techniques such as mindfulness [22, 26]. Recent work has focused on social support, noting that having a wide range of social networks can build resilience and provide ways to cope through moments of difficulty [30, 46]. Other work has focused on the act of help-seeking. For example, Pretorius et al. [49] found that supporting a sense of connectedness, credibility, personalization, and anonymity can help young people in Ireland effectively use online resources.

However, in HCI, research centering on the experiences of international students and other campus minorities has largely been ignored in favor of broadly tailoring design implications to the general student body. This is problematic, as international students from non-Western backgrounds are known to underutilize mental health services more than their domestic counterparts [21, 23, 38, 61]. This disparity in accessing and adopting such services may be due to cultural stigma, limited understanding of the Western concepts of mental health, and limited awareness of what services are available [21, 23, 38, 61]. Among the existing research on tailoring services for international students, key constructs such as social support, acculturation, and hardiness have been found to affect their mental health [25]. One avenue centers around helping students rebuild their social capital which is often lost when they move to a new country [31, 37, 44, 51]. Further, we found that Canadian students of East Asian descent need more support when using mental health technologies, including learning how to communicate their needs and be an advocate for their mental health [57]. Such challenges experienced by cultural minorities in the broader population have led counseling research to provide guidelines and frameworks to tailor practices towards multicultural clients (e.g. [15]). As well, several HCI studies on online communities explored how Asians in Asia navigated mental health through the lens of their respective cultures [48, 66], noting that they communicate and conceptualize mental distress differently than Western users. Despite this promise of inclusion, there exist very few research projects in HCI that have directly investigated the challenges faced by and the needs of cultural minorities in accessing mental health services and resources in a Western society, especially within student populations. We aim to address this gap by exploring the use of mental health resources, services, and interactive technologies by international students within the context of the campus environment.

#### 2.2 Ecological perspective

Ecological models have been used to understand and guide studies on the mental health of different cultural groups (e.g., [54, 60, 63]), mental health disorders (e.g., [40]), and with university students (e.g., [17, 30, 46]. For example, Park [46] and Lattie et al. [30] used the Social Mosaic Model that looked at university students' different levels of online social support. While a strictly social understanding can be valuable to use as a framework, as social support has been demonstrated to be a critical factor in young people's mental health, it neglects other influences that can be just as important, such as the role of university campus personnel and services. Several studies with young adults (e.g. [60, 63]) have used Bronfenbrenner's Ecological Systems Theory [8] to understand the different levels of influence (i.e., individual, interpersonal, institutional, and societal) that impact how an individual understands their mental health. These different studies have all shown that it is important to consider the different social influences affecting student mental health in both Canada and the United States (US), as it leads to a more holistic understanding of their experiences [17, 52].

We framed our study from the perspective of the social ecology of campus life as a way to understand the more holistic and complex dynamics of international students' mental health, especially where their cultural backgrounds are concerned. We chose a participatory design approach to include perspectives from different stakeholders, as it is a methodology that actively welcomes viewpoints from different stakeholders, especially if users are from vulnerable populations [39]. We recruited campus counselors and advisors as well as international students from non-Western cultural backgrounds.

#### 2.3 Personas

Personas have long been regarded as powerful tools that have informed user-centered technological designs since their introduction in the 1990s [14, 50]. They are represented as archetypical users, usually described with goals, challenges, preferences, and other contexts so as to help researchers and designers understand their target users. In HCI co-design studies in which mental health is the focus, the use of personas serves two purposes: 1) to develop empathy among the participants towards the end users, and 2) to build a common understanding [11, 49, 63]. Pretorius et al. [49] also suggest that using personas may allow for participants in a group setting to discuss sensitive topics without disclosing their own personal information, though they did not provide any empirical evidence to back their claim.

Personas, at their core, should be representative of the user [14], and past studies have used different forms of user data to empirically inform archetypical users. Pretorius et al. [49] ensured validity by collecting user data via an online survey and previous literature to iteratively generate three personas representing three types of health-seeking users: the information-seeker, the person-centered user, and the person who is experiencing a crisis situation. This method did not involve participants in the design of the personas. In another approach, Vacca [63] and Charmaraman and Delcourt [11] involved the co-design participants directly in the development of personas, bridging the gap between designer and end-user while also ensuring that the resulting personas are well-represented by the very people who are doing the designing. The added benefit of co-created personas, according to Neate et al. [42], is that they encourage empowerment and accessibility among the co-design participants who come from more vulnerable or minority backgrounds. In our study, we combined two methods of persona development (one in which the researchers used findings from a previous study [57] and the other co-created) to ensure both validity and representativeness, but also to promote accessibility and empowerment.

## 3 METHODS

Our goal for this study was to identify mental health technologies that could be more accessible to international students and inclusive of their mental health needs. A participatory design approach was chosen as it allowed international students to directly share their perspectives. In the spectrum of participant involvement in participatory design research according to Stark et al. [59], our approach was in the middle, between minimum involvement (consultation) and equal collaboration (co-production). Our goal was to provide more opportunities for our participants to take an active role in the design stages, but they were not treated as equal partners. Our research had four stages:

- Stage 1: Individual persona development
- Stage 2: Co-design and collaborative persona development
- Stage 3: Development of design dimensions and design mockups (researchers only)
- Stage 4: Participant feedback via survey

## 3.1 Participants

In total, we recruited 19 participants (14 international students, 5 mental health professionals) by advertising via the campus online paid studies website and via emails to relevant campus offices such as counseling services and advising centers. The inclusion criteria for the students specified that they should have at least some self-reported experience with mental health challenges. To screen for such experiences, we chose to use widely-used scales for anxiety and depression [29, 58], as they would uncover a general indication of mental health challenges, more so than if we had asked a single question about their mental health experiences. Anxiety and depression are also the most common mental health concerns among university students [6, 16, 30]. We used the Patient Health Questionnaire (PHQ)-9 and the Generalized Anxiety Disorder (GAD)-7 scales [29, 58], which have been found to be reliable when used with individuals from various cultures [55, 67]. We took a similar approach to the work conducted by Lattie et al. [30] who recruited students if they scored at least a 10 on either one of these scales (out of 27 on (PHQ)-9 and out of 21 on (GAD)-7), which indicate at least moderate symptoms. We also looked for a diverse representation of ethnicities and cultures, though we did find that our resultant pool of students reflected the makeup of the wider student body on our campus which is dominated by those from Asia. And finally, in order to drive ideation, we prioritized students who have had some experience using mental health technologies. However, we did include a few students who have not had the experience to give us the opportunity to discover any barriers to entry.

For the professionals, we aimed to have an accurate representation of people whose roles on campus routinely provide assistance to international students. We believed that the experiences of such professionals would contribute to a constructive discussion on how to improve students' mental well-being. The first session had five students, one counselor, and one student wellness advisor, though the advisor left while in the middle of the brainstorming activity due to technical difficulties. As a result, they did not react to others' sketches. The second session had four students, one counselor, and one graduate student advisor. The third session had five students and an international student advisor. All were given \$40 for their participation, which also included the completion of the online survey (Stage 4). Table 1 and Table 2 summarize the participant demographics, with each student listed as S(session number).(id) and each professional as P(session number).(id) to ensure confidentiality.

#### 4 STAGE 1: INDIVIDUAL PERSONA DEVELOPMENT

We decided on a collaborative approach to persona development after lengthy discussions with the research team on to how best consider our participants' potential discomfort. The primary

Student	Age	Gender	Ethnicity	Years in Canada	Student type	Has seen a counselor
S1.1	27	Female	Turkish	2	Graduate	No
S1.2	21	Male	Bangladesh	3	Undergrad	No
S1.3	20	Male	Indonesian	2	Undergrad	No
S1.4	21	Female	Taiwanese	4	Undergrad	No
S1.5	22	Male	Kazakhstani	4	Undergrad	Yes
S2.1	22	Female	South Asian	4	Graduate	Yes
S2.2	20	Female	Malaysian	1	Undergrad	No
S2.3	24	Female	West African	1	Graduate	No
S2.4	20	Female	Korean	4	Undergrad	Yes
S3.1	19	Female	Indian	1	Undergrad	No
S3.2	21	Female	Brazilian & Indigenous	3	Undergrad	No
S3.3	30	Male	Iranian	3	Graduate	Prefer not to answer
S3.4	19	Female	Indian	2	Undergrad	No
S3.5	23	Female	Chinese	4	Graduate	Yes

Table 1. Self-reported demographics of student participants; each student is listed as S(session number).(id)

Table 2. Campus mental health professionals, listed as P(session number).(id)

Professional	Campus role
P1.1	Student coordinator (departmental)
P1.2	Mental health counselor
P2.1	Graduate student advisor
P2.2	Mental health counselor
P3.1	International student advisor

concern was that discussing a sensitive topic like personal experiences with mental health issues among unfamiliar individuals and authority figures may exacerbate feelings of stigma and thus, potentially limit their willingness to speak. Our goal was to use personas to foster a safe space where students feel supported and respected, which in turn would encourage them to be more engaged in the activities. We describe in this section our design and use of Activity Cards in an asynchronous individual exercise during which participants were instructed to create their own persona of a hypothetical student with mental health concerns. These individual personas were then used to collaboratively create a single persona during their scheduled co-design session.

## 4.1 Activity Cards

The content of the Activity Cards reflects prior work in HCI mental health literature with university students and ethnic minorities [49, 57, 66]. We developed several goals, frustrations, scenarios, and coping strategies related to the mental health of minority university students. Much of the content focused on stressors and scenarios related to culture, including making sense of cultural expectations and difficulties adapting to a new culture, because we wanted to tailor the Activity Cards based on the experiences of international students. We consulted statistics on Canadian international students to create more personable characterizations of the personas, including the addition of top countries of origin of Canadian international students, namely India and China [9]. We finalized the content by cross-checking with two of the authors and other colleagues and researchers with lived experience as international students.

Our set of Activity Cards has three sections (plus a section with instructions to craft the individual personas) and is 20 pages in total. The first section consists of pairings of a mental health goal and frustration. There are four different pairings, one for each of the four cards: 1) one student who wishes to connect with others from his culture but is worried about stigma and shame (Figure 1 left); 2) another who does not feel confident about speaking up about mental health; 3) a student who only wants to rely on herself because she understands herself the best; and 4) a student who wants a

basic understanding of mental health to start using mental health apps. The second section consists of four different scenarios, also presented one per card. These scenarios include academic burnout, disagreements with parents over academic goals, difficulty transitioning to Canada as a recent newcomer (Figure 1 right), and experiencing social isolation because of being stuck at home due to pandemic travel restrictions. The third section consists of four different coping strategies [57], also written one per card. These include sharing mental health stories, learning how to communicate mental health concerns, connecting with others of their culture going through similar challenges, and learning to self-advocate for their health. These sections were followed by instructions to create their own persona of a hypothetical student. (Please see the supplemental materials to access the full set of Activity Cards.)

From India	New to Canada		
Name: Kiran Background: 26 years old, graduate student studying Computer Science Goals: 'I want a way to connect with others from my culture who are going through	Student C is new to Canada. When he arrived, he was very excited about living in a new country. However, he's finding classes more difficult than expected and is in danger of failing. His professors expect him to participate but he doesn't feel comfortable because in his country, students are not expected to speak out in		
similar experiences but without all the stigma and shame." Frustrations: "In my culture, people do not focus on mental health. They feel that it is normal to get stressed and have anxiety. There is also substantial stigma around seeking help for mental health, which further exacerbates the issue. I feel that it share anything that is bothering me with my family, they will worry. Sharing my concerns with other students going through a similar experience would be great but I worry about my reputation and diamit. If my identity is revealed."	class. His classmates and friends try to help but he's too embarrassed to accept. This has caused awkward tensions in his friendships. Generally, he just can't seem to adjust to the new culture. Lately, he has been spending more and more time isolating himself in his room, unsure what to do.		
3 67 20	10 at 20		

Fig. 1. Two pages from the Activity Cards: example of a mental health goal and frustration (left) and an example of a scenario (right)

# 4.2 Procedure

One week before their scheduled co-design session, we asked each participant via email to read through all three sections of the Activity Cards and then generate their own individual persona of a hypothetical student. They were instructed to combine elements from each section (i.e., goals and frustrations, scenarios, coping strategies) that resonated with them the most into a cohesive persona using a given template, with the option to add or tweak any of the materials to represent themselves better. Once all personas had been received, two researchers took the features and elements that came up the most frequently and merged them into one persona showcasing a hypothetical student. This resulting persona was then used to seed a discussion in the co-design session (Stage 2), during which time was allocated for the participants to collaboratively refine the merged persona that they would be using for the remainder of the session. We followed this procedure before each scheduled co-design session. In total, we collaboratively finalized three personas, one for each session. As an example, please see Figure 2 for the persona finalized in session 2.

# 5 STAGE 2: CO-DESIGN AND COLLABORATIVE PERSONA DEVELOPMENT

## 5.1 Procedure

To more easily manage the participants so that everybody had an opportunity to speak, we split up the participants into three 90-minute sessions. Each session was comprised of different groups of students and professionals from the University of British Columbia, a large Canadian university. All three sessions were conducted remotely by two authors using Zoom and Miro, an online conferencing/virtual meeting platform and a visual collaboration platform, respectively. All participants were given the option to turn off their camera feed and to use aliases while interacting on Zoom and Miro. However, we did encourage the professionals to use their real names and turn on camera

Name: Ana Type of Student: Undergraduate student studying Biology	Goals: "I want a way to learn about how to be confident about speaking up about my mental health." Frustrations: "I didn't have much experience talking about mental health growing up. I now find it difficult to open up since struggling with mental health is often seen as weakness in my culture and I'm scared of judgement. I want to start talking about my mental health like I see others doing on social media because I think I can be more mentally healthy if I can talk about it, but I'm just not confident. I've spoken with school counsellors before, but they did not understand why I'm so hesitant to open up and proposed solutions that I thought were unrealistic (e.g. struggles with communication, not being able to access resources and opportunities, difficult to apply solutions because of cultural sensitivity, feelings of isolation because disconnected from rest of campus)."		
Scenario: Stuck at home Ana is a new student at UBC. Due to Covid-19 restrictions, she cannot travel to Canada and is instead taking courses remotely from home. Her classes are held in the middle of the night and for that reason, she sleeps during the day. Without a good way to connect with classmates or make new friends and being isolated from her family and friends at home due to her schedule, she notices that her mental health is deteriorating. She has thought about contacting the university counseling services but knows her family would not approve if they found out. She needs help without alerting everyone at home what she's going through.	Coping Strategy: Sharing mental health stories In a prior study, we found that some students liked the idea of using stories and storytelling to share and read about mental health distress online. Due to mental health stigma, they found it easier to use stories as an indirect way of sharing their mental health experiences rather than talking about them more directly. How would you design an app or an interactive website to support this student who wants to share stories with their peers?		



feeds in hopes that this transparency would benefit the students in the session. All students elected to remain anonymous while the counselors and advisors all used their real names and began their session with the camera on but eventually turned it off as the session shifted to Miro. The lead researcher led the sessions, using a script to introduce the study and direct the different activities of each session. The other researcher took notes, audio recorded the session, monitored the chat, and resolved any technical issues. To ensure everyone had an opportunity to speak, we structured the sessions to explicitly call out participants for their input and had them present their designs in a round-robin format.

Miro was set up by the researchers to help guide participants through four different activity modules, starting with an ice-breaking exercise to give the participants time to familiarize themselves with features on Miro (~10 minutes). The second activity (~20 minutes) focused on collaboratively discussing and refining the persona that the researchers had merged from the participants' individual persona submissions. This step was carried out with the lead researcher making edits proposed by the participants, followed by a discussion of changes made. The third activity (~20 minutes) was reserved for brainstorming designs. The researchers asked participants to consider apps, websites, wearables, or any type of technology that could help the persona with their mental health. They were told to enter as many ideas as they could on sticky notes and place them in a reserved space in Miro. The fourth activity (~35 minutes) involved each participant choosing any idea from the brainstorming activity to sketch out what the technology could look like and how it could be used. We instructed participants to sketch offline on a piece of paper and then upload a picture of the sketch to the Miro board once finished. We decided to do the sketching offline because our pilot studies indicated that sketching online on Miro might be difficult for some participants. After 10 minutes of sketching, the participants one-by-one (round-robin style in the order of uploading their sketch) presented their idea to the group and led a discussion on the merits and pitfalls of the

design. After each presentation, we directly called on 2-3 different participants for their feedback. We asked the students about their impressions of the presented sketches while the professionals reflected on the sketches based on their professional opinions and experiences. We finished the session by giving the participants time to reflect on the session and to inform the researchers about what worked well and what could be improved. The script and a screenshot of the Miro board template can be accessed in the supplemental materials.

# 5.2 Analysis

The data collected from the three sessions consisted of brainstormed ideas and sketches of designs as well as audio recordings which were transcribed by one researcher. We also analyzed follow-up emails that several participants sent because they found it more comfortable to contact us privately with their reflections instead of sharing them in a group setting. Using thematic analysis as described by Braun and Clarke [7], we came up with different design features and elements that students look for that can help with their mental health needs and challenges based on the data collected. We especially focused on the accessibility of designs so as to help students overcome the stigma and cultural barriers as new students to Canada that impede or delay their use of mental health services and resources. The analysis of the data reflects our social constructivist stance, and we make no claim on finding objective results. This is because the data for the personas and from the sessions only reflect a localized international student experience in one Canadian university. However, our findings do indicate possible directions to take in the design of mental health technologies to be more sensitive toward students who may be hesitant to access mental health care.

# 5.3 Findings

We developed three themes that our participants deemed were important from our design sessions: support, interactions, and safety. These findings helped us to frame concrete design dimensions our participants look for in technologies for mental health.

# 5.3.1 Types of support.

Designs for Social Support. Eleven out of 19 designs touched on ways to create and expand social capital, an important undertaking for international students who arrive in Canada without a local social network to depend on. P3.1, an international student advisor, noted that new students are typically overwhelmed by the unfamiliarity of Canadian culture and educational systems, and they tend to stay within their own cultural circle or isolate themselves as coping mechanisms. His suggestions centered on supporting "cultural breakthroughs," helping students go beyond the comfort of their own culture to become a "global citizen" to make the adjustment easier. In essence, the students have difficulty adapting to new cultural expectations, which could be handled by creating new relationships with peers. He said, "Our technology needs to be more interactive with other people and allow for a wider range of interactions." He particularly favored designs that encouraged students to meet new people, such as those that matched students like dating applications (e.g. Tinder). Many of the students in the three sessions agreed that matching was important and proposed their own matching designs. However, one student cautioned: "What if... [someone] from a similar background... ends up reinforcing cultural stigma or spreading misinformation?" (S2.1). This warning aligns with P3.1's advice on supporting cultural breakthroughs, that expanding the social network beyond those of their own culture may be beneficial and lead to alternative ways of adjusting or resources.

*Designs for Self Support.* Eight out of 19 designs centered around supporting the user without the assistance of others. Mostly advocated by the student participants who have not had experience with counseling, their ideas mainly focused on the use of artificial intelligence (AI) to help users

understand more about themselves or learn to be more comfortable communicating difficult mental health topics. One design that was well-received by the participants in the third session involved an AI-driven counselor: "An AI counselor... can help you, give you advice on how to talk about [mental health] so you can start to feel comfortable talking about it but without people judging you" (S3.1). However, she pointed out: "But I'm not sure how it can be helpful for things related to my culture" (S3.1). Another design centered on questions as prompts to start reflecting on users' emotions, giving them the "vocabulary to start piecing together how to communicate [the] emotions" they are experiencing (S3.5). P2.2 and P2.1 also agreed that the use of AI in the designs can be beneficial when a similar design came up in their session.

Designs for Professional Support. The only designs (3 out of 19) that explicitly involved professionals came from the counselors and advisors themselves. And while initially hesitant with such involvement, the students gradually came to understand the need for some level of participation from the professionals. This suggests that the international students' adoption and awareness of services offered on campus is low, which could be a design opportunity to explore. In one of the designs, P1.2 introduced a game that gave students an opportunity to meet with other students, faculty, advisors, and health professionals in a virtual campus reminiscent of Gather Town [24], a website where users can create virtual spaces to interact with their communities (see Figure 3). In another session, P2.2 described her design with a dinner party metaphor (see Figure 3) to show how the user can remotely talk with other students and a mental health professional in a casual dinner party setting. The students in this session welcomed this design because they perceived it to be less intimidating than a typical group counseling session. One student said, "I like that everyone is equal here because we're all just guests at a party... we have something to offer, too. The counselor isn't the only expert" (S2.2). This suggests that providing opportunities to dispel students' perceptions of a well-defined boundary between a mental health professional and themselves may help to destignatize the seeking of professional support.



Fig. 3. Three example sketches from the co-design sessions: P2.2's dinner party sketch (left), P1.2's virtual campus sketch (middle), S2.3's digital human library (right)

#### 5.3.2 Types of interactions.

Formal interactions feel threatening. For many of the students, the thought of using apps was perceived to be just as intimidating as seeing a mental health professional. One student said,

Proc. ACM Hum.-Comput. Interact., Vol. 7, No. CSCW2, Article 258. Publication date: October 2023.

"[Using] mental health apps ... it feels a little threatening, like, overwhelming and it's very serious, right? Very heavy" (S2.4). One student (S3.5) who had attended counseling in the past proposed having users start off with less formal resources or coping strategies and then gradually move on to more formal ways of seeking help. She said of her AI-prompted journaling design: "Something that... start[s] off small and then do bigger things that's like scientifically effective... like reach out to someone in real life."

Informal interactions are desired. Overwhelmingly, our student participants came up with and responded favorably to informal ways to interact and use technologies. Ideas around gamification, where rules for engagement were clear-cut while at the same time considered informal, were introduced by both students and professionals as being approachable and engaging. For example, social accountability and competition were touted as a fun way to meet milestones, such as introducing oneself to someone new. S3.2 said of her question-and-answer design to help users learn how to communicate their mental health: "Try to bring a little bit of joy... Not like a dark, spiraling moment of your day."

Another aspect of informality centered on how explicit the purpose of the technology is. One student cautioned: "I don't have the freedom to do things for my mental health... with multiple generations living in the same house" (S2.1). This echoes findings from Lattie et al. [30] in which authors noted that students frequently lack private space to make phone calls and suggested more discret text-based designs. This preference for "less obvious" designs was evidenced by the Digital Human Library sketch proposed by S2.1 (see Figure 3). She described her idea where students can learn about other students' experiences with mental health with some oversight from professionals to ensure safety: "It's tailored towards seeking support but not in an obvious way... I think bridging that gap is important."

Storytelling to communicate their mental health was also popular. Discussion around how to best communicate and learn about unfamiliar mental health topics led to creative ways to articulate emotions and daily struggles. Suggestions included using cartoons, memes, emojis, and visual storytelling templates. One student said, "I like the idea with things that go beyond words. Cartoons are a good idea... less tense and more of a fun way of reflecting" (S3.2). In all, the students' desire for informal ways to interact seemed to reflect their desires to soften the approaches to mental health because of cultural stigma and unfamiliarity with mental health, which suggests that navigating cultural expectations is a big challenge for this population.

*Flexibility in frequency and level of planning desired.* For our participants, informal interactions also meant not having to worry about making appointments to see a professional or setting a strict schedule to meet certain milestones. Several students talked about spontaneous meetups online for in-the-moment social support. One student said in reaction to P1.2's virtual campus design: "Sometimes I just want to talk to someone but not have to wait for an appointment. I think apps and stuff should be fluid based on what I need at the moment" (S1.2). Thus, level of planning and frequency of interaction were important elements in making designs less formal and more approachable.

*5.3.3 Types of safety.* Our participants defined safety as having two dimensions: user control over anonymity and protection from harmful content. With regard to anonymity and social support, while all participants agreed that strict enforcement of anonymity was necessary to guarantee safety, several students thought that having control over how much their identity and personal lives are revealed could be an effective way to connect with others who are experiencing similar challenges. S3.4 shared this sentiment with their sketch of a Tinder-like matching app: "Once someone gets on this platform, you already know they're vulnerable like me... so I think it would be okay if there were no boundaries on what you can talk about [with them]." This nuanced desire for different levels of

Design dimension	Sub-dimension
Support	Self Social Professional
Interaction	Formality Frequency Planning
Safety	Anonymity Professional oversight

Table 3. Design dimensions of mental health technologies

anonymity suggests that exploring designs around personalized anonymity can be a good way to resolve their challenges with cultural expectations, perhaps by connecting with more people and thus, experiencing cultural breakthroughs. There were also differences between the students and professionals in how much professional support should be expected to be featured in the designs. For most of the student participants, designs that called for explicit interactions with professionals were remarked on as intimidating, though they did acknowledge that professionals' expertise may be beneficial to students' mental health. Only when gently prompted by the counselors and advisors during the sessions did they recognize the need for some level of involvement by professionals, with some students, over time, acknowledging the role of professional oversight in promoting a safer online environment.

## 6 STAGE 3: DEVELOPMENT OF DESIGN DIMENSIONS AND DESIGN MOCKUPS

Directly based on our findings, the research team in collaboration with other HCI researchers in our research cluster were able to identify design dimensions and sub-dimensions. Table 3 shows the design dimensions, sub-dimensions, and the different levels on a continuum where the design can support the sub-dimensions. As the research team refined these dimensions, the constructs of helpfulness, comfort, and trust kept emerging in our discussions, and the associated user goals to maximize helpfulness, comfort, and trust. These goals were also heavily discussed as we iterated on the design mockups; more specifically, we attempted for our mockups to, as much as possible, meet all three of these goals. (In Stage 4, we decided to explicitly ask our participants about the three constructs.)

We then used the design dimensions to develop four mockups, which were used as elicitation probes to further collect perspectives on the use of mental health technologies. We took a similar approach to several studies that explored design dimensions [2, 18, 64]. In our selection process of participants' sketches, we took into consideration the depth of the discussions when the sketches were introduced in the sessions, as well as the extent to which the sketches diversely represent the design dimensions. Two researchers analyzed each of the participant sketches from the sessions based on the levels in Table 3, marking each as either high, medium, or low. We selected four designs: Virtual Campus (introduced by P1.2), Digital Human Library (introduced by S2.3), Dinner Party (introduced by P2.2), and AI Counselor (introduced by S3.1). Table 4 shows the breakdown of the results of the analysis.

The sketches informed the basis of the mockups, and then we created and iterated on a small set of still images of what the design could look like as a mobile application. We further crafted storyboards to embellish the mockups' functionalities and to understand user motivation. We used the Sketch desktop application, incorporating feedback from different stakeholders including two international students and several HCI researchers from our research cluster. Storyboard 3, Digital

Design sketch	Support	Interaction	Safety
Dinner Party	Self (low), social (high), professional (high)	Formality (medium), frequency (up to low), planning (high)	Anonymity (medium), prof. oversight (high)
Virtual Campus	Self (low), social (high), professional (medium)	Formality (low), frequency (up to high), planning (low)	Anonymity (medium), prof. oversight (medium)
Digital Human	Self (high),	Formality (low),	Anonymity (high),
Library	social (high), professional (medium)	frequency (up to high), planning (low)	prof. oversight (high)
AI Counselor	Self (high), social (low), professional (low)	Formality (low), frequency (up to high), planning (low)	Anonymity (high), prof. oversight (low)

Table 4.	Design	dimensions	of o	ur four	mockups

Human Library, can be seen in Figure 4. The other three storyboards are in the appendix. The full set of storyboards can be accessed in the supplemental materials.

## 6.1 Storyboard 1: Dinner Party App

This storyboard and design centers on an international student (Chang) who feels comfortable enough to seek out a counselor, but still has misgivings about attending counseling on her own. Using the Dinner Party app, she starts to describe her concerns by clicking on keywords generated by the system or via her own words. The app puts together a list of students who may be experiencing similar concerns, which a campus counselor then uses to schedule a group session by sending out invites. Once Chang accepts the invite, she is tasked with contributing "dishes" of her own experiences and skills. During the session, she can see others' dishes, including those prepared by the counselor. The premise of the design is that everyone, including the counselors themselves, are experts of their own experiences. The hope is that this more approachable environment evens out the power dynamic between the counselor and students, lessening the fear and stigma surrounding the discussion of mental health and seeking help.



Fig. 4. Storyboard 3, Digital Human Library

# 6.2 Storyboard 2: Virtual Campus

This storyboard and design show a virtual campus where students, campus health experts, and advisors can freely meet with each other through personalized avatars. The app also highlights gamification in the form of daily challenges (e.g. chatting with someone new). In the storyboard, a newly admitted international student (Ana), wishes to meet other students and experience campus life prior to her arrival in Canada. However, still being abroad and feeling anxious about making new friends, she finds it challenging to meet this goal. Through her avatar and an alias, she was able to virtually meet a student and has plans to meet a counselor. The goal of this design is to promote a wider circle of social connections and to create cultural breakthroughs, as advocated by P3.1.

# 6.3 Storyboard 3: Digital Human Library

This storyboard and design highlight a conceptual model of a library in which students can "borrow" and read other students' stories of their mental health experiences. Users can search or browse through different profiles of storytellers based on similar backgrounds and experiences, such as those from the same country of origin or educational goals. This design allows students who may be less familiar or experienced with mental health concerns to gain insight into how others are dealing with their challenges. When they feel more comfortable, they can consider more active ways to interact with the story producers, such as directly communicating with them. The idea is to curate mentorships through stories as a design metaphor, guiding readers in their journey to a better understanding of how mental health is navigated in Canada [57]. Although the experience of consuming others' posts may superficially resemble online communities like Reddit and social media, the difference is that 1) the stories are overseen by campus health experts; 2) the storytellers and story consumers are all limited to current students to guarantee a safer environment and are more likely to have shared characteristics, perhaps fostering a sense of relatability or comradery; and 3) readers are able to see valuable contexts across stories instead of piecing together isolated posts from different platforms.

# 6.4 Storyboard 4: AI Counselor

The final storyboard and design involve the use of natural language processing to support conversations through voice assistance. We aimed for the voice interaction with an AI to be completely private, which would enable users to practice talking about their mental health without the stigma of sharing sensitive information with real people. The transcripts and recordings of each voice session are saved for future reference, as well as answers to prompts that ask about user comfort level. We incorporated elements of personal informatics to help users understand how they have progressed in terms of overcoming stigma and gaining the confidence to talk about their mental health challenges. The overall objective is for users to feel more comfortable talking about their mental health with prompts from the AI system to help guide them. We incorporated questions to guide users during their session, as prior work [57] has found questions to be helpful for users in framing how they think and talk about mental health.

# 7 STAGE 4: PARTICIPANT FEEDBACK VIA SURVEY

The survey aimed to use the mockups and storyboards as elicitation probes for deeper and more meaningful participant feedback on the designs. We decided on an online survey to give our participants ample time to carefully think over their answers and also to give them the space to respond without the added discomfort of having to talk about highly personal moments with an

audience. This was especially important because, during the co-design sessions, we suspected that the group discussions inhibited several students from freely participating.

## 7.1 Procedure

After developing the storyboards and mockups, we created two surveys, one for the students and the other for the campus professionals. The surveys consisted of a mix of open-ended and 5-point Likert scale questions. We shared the link to the surveys with our participants. Student surveys focused on whether they would be interested in using the designs as given in the mockups and whether they had any reservations. We also asked questions about user goals (i.e., helpfulness, comfort, and trust) that emerged in our discussions earlier in the development of the design dimensions and mockups, as we believed that these constructs could elicit interesting responses on what they prioritize and value. The campus professional surveys probed their expert opinions on the advantages and disadvantages of students using the designs and how they could be incorporated into their everyday practice. Both surveys also touched on their general feedback on the co-design sessions, including their views on the collaborative development of personas. The surveys can be found in the supplemental materials. For one advisor, based on their request, we conducted an in-person interview, using the same set of questions as the survey. The interview was then transcribed and analyzed in the same manner as online surveys.

We used thematic analysis [7] in the qualitative responses and transcript, and descriptive statistics in our Likert scale responses. The thematic analysis was conducted deductively using preconceived themes of helpfulness, comfort, and trust to further our understanding of these user goals, as well as inductively to capture other insights. Two researchers individually coded the data and then iterated on the cohesion of the resultant findings together with feedback from a third researcher and others in our research cluster. The following results showcase what design features and implications our students believe would help them overcome barriers to entry and adoption of mental health technologies. We also provide responses from the counselors and advisors that anchor the students' responses with their professional insights.

# 7.2 Findings

7.2.1 Overview of participants' preferences. The most well-regarded design was the Digital Human Library, with six students and two professionals voting it as their favorite. Virtual Campus came second among the students, with four students indicating their preference for it. Dinner Party was more well-regarded by professionals than students, three and two individuals, respectively. AI Counselor received the least number of votes, with two votes from students inexperienced with mental health discussions based on their self-report. Next, we present our thematic analysis findings.

7.2.2 Helpfulness. One key indicator that student participants look for in a design is perceived helpfulness. Although various forms of perceived helpfulness were mentioned, the definition that most students resonated with was that professional support could provide the most help. A Likert scale question on perceived helpfulness (5 being most helpful to 1 being least helpful) found that professional help was regarded as the most helpful (M=4.4, SD=0.65), followed by self help (M=3.7, SD=1.25), and lastly, social help (M=2.93, SD=1.16). Their preference for professional support was rather surprising, as 11/14 of the students reported having no experience with counseling due to their own stigma and discomfort, yet there was unanimous agreement that they considered professional services to be a gold standard and something to strive for. One student wrote: "No one is [an] expert except the experts. I think it's very unwise to go to someone who is not [an] expert for help" (S3.3). Self support was considered important because they felt like they knew themselves

while professionals would be uninformed about their cultural norms. As for social support, the students did acknowledge that it has its place, especially if the design could guarantee professional oversight as well as agency for students to approach social help on their own terms. One student said: "One perk of [Digital Human Library] is that it is very accessible and convenient, you can use it for as long or as short of a duration as you want. You read the stories in your own time... It's helpful when you need it" (S2.3). This shows that having the flexibility and agency to seek help is considered important. Some students also remarked that the ability to control how they appeared to others, whether anonymously or not, was considered important.

7.2.3 Comfort. Preferences for comfort were clearly important, as can be seen in their responses to the Likert scale question on how they felt about the three types of support (5 being very comfortable to 1 being very uncomfortable). They by far preferred self support (M=4.21, SD=1.23), followed by professional support (M=3.86, SD=0.95), and lastly, social support (M=2.93, SD=1.07). Their definition of comfort was closely tied to risk, privacy, and limiting personal information from being made public. One student wrote: "Social help technologies [would not work] well for me... I'm just not comfortable [sharing] so freely because of my culture" (S2.4). Students saw self and professional support as being less risky and thus more comfortable in comparison to social support, which was perceived to increase the likelihood of information on their mental health being made public. However, these feelings did not automatically lead to an outright rejection of the mockups that provide social support. This is evident in students' top picks for Digital Human Library and Virtual Campus, which are both high in social support. For the students, comfort seems to be contingent on whether anonymity could be guaranteed in the design.

Comfort also meant resonance or the relatability of the people they interact with. S2.2 wrote of the Digital Human Library: "From my experience, UBC can feel very very big... and it's very easy to feel unseen or unheard. Being able to read about individual students like this and their stories would really help me to feel more connected, more seen, and more like I belong, especially if their stories resonate with my own personal/cultural experience." This feeling of belonging and representation could be especially vital for new international students in need of social capital who are confronted by unfamiliar cultural norms.

Most students found the more informal designs with less explicit terminologies and interactions with professionals to be more approachable and comfortable. However, that informality was seen as being too implicit for some participants. For example, S3.5 who has been to counseling before, made the following remark about the Virtual Campus design: "I feel like this app is more social-focused than mental health-focused so I don't really see how it can do much in addressing my stigma and cultural barriers to mental health."

7.2.4 Trust. Student participants often considered trust to be a critical factor in deciding which mental health technology to use. Their definition of trust was closely tied with helpfulness and comfort, especially regarding the credibility of the intervention and privacy risks. S1.2 described his struggle juggling these different aspects: "I think for me it's a level of trust. I trust professionals even though I've never seen one before because they're trained to help... I trust myself but in a different way. I know how I think and react and there's no fear about oversharing and that comforts me knowing that no one else is witnessing my struggles." However, several students found that they could not trust themselves to get through mental health hardships: "I can't trust that I know what is best for me. I just don't have the training" (S2.1). Social help was similarly viewed: "I don't trust other people so social help is not something that I think I'll ever use" (S1.2). This complex understanding of trust led to a variety of responses to the mockups. The Digital Human Library seemed to allow the students to gradually trust themselves by learning from peers within an environment where credibility was guaranteed by professionals. Virtual Campus seemed to

have less of a guarantee because the interactions between students were not closely monitored by professionals.

In sum, we found that increasing helpfulness could be had by exploring ways to meaningfully connect the student with professional involvement. Comfort was highly correlated with self support but there seemed to be opportunities where social support can bring about the desired comfort if relatability of peers is highlighted. And finally, trust seemed the most complex, but the most promising approaches seem to be to demystify social support, engage the professionals, and provide learning opportunities to the students.

7.2.5 Use of personas. Student participants had quite a positive reaction to the use of personas. The Likert scale question asking about how comfortable they felt using the personas (5 being much more comfortable to 1 being much less comfortable compared with not using one at all) showed that the students felt comfortable talking about their mental health via a hypothetical student (M=3.79, SD=1.05). However, some of the students who had attended a counseling session in the past rated their comfort level as either unchanged or somewhat less comfortable when using a persona: "I felt like talking from the perspective of a hypothetical student felt a bit less authentic, and I still ended up drawing from my past experiences" (S2.4). The two researchers overseeing the workshops also noticed this, sometimes even going as far as reminding some of the students to more explicitly consider their persona. On the other hand, the students with less or no experience with mental health professionals viewed the use of a persona as a benefit: "Using the persona actually helped me to understand mental health from the perspective of an outsider so it wasn't as uncomfortable as it could have been" (S1.2). This suggests that the use of personas in sensitive HCI research like mental health can indeed be valuable for creating a comfortable environment, but may be worth using only with those who find the topic especially challenging to discuss.

## 8 DISCUSSION

Through the storyboards, we aimed to understand what types of designs can help international students navigate their mental health and access the services and support they need. We found that the students looked for and deeply considered design features that offered promises of helpfulness, comfort, and trust in technologies for mental health. Types of support seemed to be the most critical variable, as the students made connections between how each support type could be valuable in accommodating their stigma and cultural barriers which has led to an unfamiliarity with mental health. They responded most positively to the storyboards where the three types of support were evident, which strongly suggests that effective designs for this population need to incorporate all three: self support to give users a sense of comfort and desired self-reliance, social support to help normalize discussions, and professional support to help moderate potentially harmful content and to ensure trusted content. In all, we found special care needs to be given towards providing a more accessible experience by explicitly presenting values of helpfulness, comfort, and trust. However, maximizing these values may not be possible and could be an interesting topic to pursue in future studies.

We found that the Digital Human Library has the potential to provide widespread support for users with different experiences and stigma levels. This flexibility in design may be effective in helping students from different cultural backgrounds who may find social support less helpful. Research has shown that social support for East Asians and Asian Americans needs to take into account social strain and overly intrusive interactions due to potentially negative consequences when sharing distressing news [28, 53, 62]. Thus, supporting an indirect method of social support, like the one in the Digital Human Library, may be the best approach for some students. Indeed, several of our student participants felt some reservations about pursuing social support. This

finding is in contrast to other HCI work that heavily promotes peer social support among university students [30, 46] without meaningful discussions on the negative repercussions it can bring to students used to different cultural expectations around mental health. Additionally, we previously noted that support is needed for students of East Asian heritage to engage with technologies for mental health, such as promoting storytelling and skill learning from peers [57]. We learned that this holds true for our international students as well, but with this study, we found that flexible approaches that support different levels of helpfulness, comfort, and trust are needed.

Next, we list several design implications that can give guidance to HCI researchers and designers working with international or cultural minority student groups.

#### 8.1 Design Implications

*8.1.1 Mental health technologies should incorporate some professional support.* While self support and social support design elements could be helpful, it is mainly the expertise from professional support that would be more objectively helpful for international students. However, the involvement of professionals must be designed sensitively to consider the discomfort that such an engagement can bring. As evidenced by our student participants who expressed hesitation at involving professionals and also by prior work on the social ecology of university students [30, 46], future work should consider how best to destigmatize the seeking of professional support and envision new ways for professionals to be more clearly engaged with the community. Future work should also consider pragmatic ways for mental health experts to provide their services amidst budgetary and time constraints.

8.1.2 Mental health technologies should destigmatize social support. According to their survey responses, several student participants reported that they would be uncomfortable receiving social support. However, there exists substantial research on the mental health of young adults and university students that stresses the importance of social networks and peer support [20, 35] in building mental health resilience and literacy. This implies that technologies should be mindful of users' discomfort and be developed in a manner that combats this barrier to entry. One way is to scaffold the exposure to and experience with discussion of mental health and well-being, gradually increasing comfort and dispelling stigma. This approach can also be more sensitive towards cultural minorities who find direct social interactions unhelpful [28, 53, 62]. Thus, designs that can grow with the user may be particularly effective. For example, our students responded positively to the Digital Human Library design as it accommodates both a passive mode of social support (i.e. reading stories of others' experiences) and the more active social interactions (i.e. reaching out to the storytellers).

8.1.3 Mental health technologies should support user agency. As international students negotiate helpfulness, comfort, and trust in their interaction with mental health technologies, it is important that mental health technologies give users the flexibility to approach their mental health according to their own schedule and comfort level. This is important for international students, as they may need to unlearn the cultural expectations and stigma around mental health before seeking the help they need [57]. Our designs highlight the importance of promoting user agency in multiple ways. For example, we speculate that the reason for the popularity of the Digital Human Library, as well as Virtual Campus, is the freedom they afford the students more control, and thus empowerment, over their mental health journey, instead of being dictated to steps they must take but are not yet prepared for. Levels of anonymity can also help provide more control over what narratives are attached to their identity. As our students remarked, the ability to find more meaningful and

helpful connections online may outweigh wishes for anonymity. Future work should explore other ways to give students agency to help overcome barriers to entry in a sensitive manner.

#### 8.2 Value of using ecological perspectives

We found several opportunities to help the students by increasing helpfulness, comfort, and trust based on taking a broader social perspective of campus life. We encouraged the students in the co-design sessions to look beyond themselves and their own narrow social circle to understand the roles campus professionals and services play in their mental health-seeking practices. However, in previous work in HCI mental health with university students, perspectives from mental health professionals tend to be minimized [30, 46]. Future work should consider ways to take the perspective of these mental health professionals to understand how technology can enhance their work to provide more effective care for their students (similar to [60]). We also brought in explicit cultural content in the form of Activity Cards to prompt the students to think about how their cultural background has influenced their perception of mental health and also to ideate potential designs with culture as a focus. We believe that taking this broader social view allowed our student participants to deeply reflect on how to be included in mental health conversations on campus, which is important because mental health from non-Western perspectives tends to be considered private and thus not talked about [57]. Thus, similar to Vacca's work with Latina teenagers [63], we believe that any future work on the mental health of minorities must consider how best to include cultural and social perspectives in the study design.

# 9 LIMITATIONS

One limitation of this study is the representativeness of participants. Though we recruited a diverse set of international students and professionals in one large Canadian university, we recognize that our sample of participants may be skewed towards those who are more likely to engage in mental health discussions with others. Therefore, they may not be representative of the needs and challenges of all international students in Canada. Another limitation is the gender balance of the participants, which skewed more female, as is common in mental health studies with young people [30, 34]. We also recognize the limitation of our study design, which constrained the time the participants had together so that students' discomfort can be minimized. It might have been that with more time, students' discomfort would have been lessened as they grew more accustomed to the platform and other participants. The participation of the professionals may also have influenced the students as they progressed through the study: the students seemed to more highly value social support in the designs they proposed in Stage 2 but gravitated towards professional support in the survey. There is a possibility that the students would not have shifted their preferences had they not been exposed to the professionals in the study. Thus, a concern is that the findings may not be truly representative of their preferences. Despite these limitations, our findings provide valuable insight into how technology can be designed to increase accessibility among international students. Finally, our use of culture is loosely defined and used, and thus we did not have enough depth in the data to differentiate the cultures that were represented. As well, we did not have sufficient data to claim any differences between graduate and undergraduate cohorts, which may be valuable to explore in future work.

## **10 CONCLUSION**

This study presents the types of design elements that international students and campus professionals desire that can help students access mental health support at their university. We focused on international students from non-Western cultural backgrounds to understand from an accessibility standpoint how to design mental health technologies for people with cultural stigma and lower familiarity with Western approaches to mental health. This participatory design study incorporated broader campus and cultural contexts in which the participants were situated to supplement our understanding of their mental health experiences. Our study contributes (1) a method for collaborative development of personas that enabled our participants to discuss mental health more comfortably; (2) empirical findings which were then developed into a set of design dimensions that helped conceptualize what our sample of international university students need and look for in mental health technologies; and (3) an empirical understanding of how our international student participants negotiate helpfulness, comfort, and trust when they consider what technologies to adopt. This study found that incorporating professional support, destigmatizing social support, and supporting user agency may help international students to overcome barriers to using mental health technologies. Among the design mockups, the Digital Human Library seemed the most promising in providing flexible social support for students with different experiences and stigma levels. Our findings suggest the importance of continuing research with international students as well as other minorities when developing more inclusive mental health technology designs.

#### ACKNOWLEDGMENTS

We thank the participants and the people of the eDAPT and MUX labs for their valuable feedback. This work was supported by funding from the Natural Science and Engineering Research Council of Canada (NSERC) Designing for People (DFP) CREATE Grant.

#### REFERENCES

- Lala Acharya, Lan Jin, and William Collins. 2018. College life is stressful today Emerging stressors and depressive symptoms in college students. *Journal of American College Health* 66, 7 (2018), 655–664. https://doi.org/10.1080/ 07448481.2018.1451869
- [2] Jessalyn Alvina, Andrea Bunt, Parmit K. Chilana, Sylvain Malacria, and Joanna McGrenere. 2020. Where is That Feature? Designing for Cross-Device Software Learnability. Association for Computing Machinery, New York, NY, USA, 1103–1115. https://doi.org/10.1145/3357236.3395506
- [3] Jeffrey Jensen Arnett. 2000. Emerging adulthood: A theory of development from the late teens through the twenties. American psychologist 55, 5 (2000), 469. https://doi.org/10.1037/0003-066X.55.5.469
- [4] American College Health Association. 2016. American College Health Association national college health assessment II: Canadian reference group; data report, spring 2016. Retrieved April 13, 2021 from https://www.cacuss.ca/files/ Research/NCHA-II%20SPRING%202016%20CANADIAN%20REFERENCE%20GROUP%20DATA%20REPORT.pdf
- [5] American College Health Association. 2019. American College Health Association national college health assessment II: Canadian reference group; data report, spring 2019. Retrieved April 13, 2021 from https://www.cacuss.ca/files/ Research/NCHA-II%20SPRING%202019%20CANADIAN%20REFERENCE%20GROUP%20DATA%20REPORT.pdf
- [6] Jessica L Bourdon, Ashlee A Moore, Elizabeth C Long, Kenneth S Kendler, and Danielle M Dick. 2020. The relationship between on-campus service utilization and common mental health concerns in undergraduate college students. *Psychological services* 17, 1 (2020), 118.
- [7] Virginia Braun and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative Research Psychology* 3, 2 (2006), 77–101. https://doi.org/10.1191/1478088706qp063oa
- [8] Urie Bronfenbrenner. 1992. Ecological systems theory. Jessica Kingsley Publishers, London, UK.
- [9] Statistics Canada. 2020. International students accounted for all of the growth in postsecondary enrolments in 2018/2019. Statistics Canada. Retrieved May 1, 2022 from https://www150.statcan.gc.ca/n1/daily-quotidien/201125/dq201125eeng.htm
- [10] Yves JA Chaput and Marie-Josée Lebel. 2007. Demographic and clinical profiles of patients who make multiple visits to psychiatric emergency services. *Psychiatric services* 58, 3 (2007), 335–341. https://doi.org/10.1176/ps.2007.58.3.335
- [11] Linda Charmaraman and Catherine Grevet Delcourt. 2021. Prototyping for Social Wellbeing with Early Social Media Users: Belonging, Experimentation, and Self-Care. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) (*CHI '21*). Association for Computing Machinery, New York, NY, USA, Article 704, 15 pages. https://doi.org/10.1145/3411764.3445332
- [12] Juliet Honglei Chen, Yun Li, Anise MS Wu, and Kwok Kit Tong. 2020. The overlooked minority: Mental health of International students worldwide under the COVID-19 pandemic and beyond. *Asian journal of psychiatry* 54 (2020), 102333. https://doi.org/10.1016/j.ajp.2020.102333

Proc. ACM Hum.-Comput. Interact., Vol. 7, No. CSCW2, Article 258. Publication date: October 2023.

- [13] Michelle Cleary, Garry Walter, and Debra Jackson. 2011. "Not Always Smooth Sailing": Mental Health Issues Associated with the Transition from High School to College. *Issues in Mental Health Nursing* 32, 4 (2011), 250–254. https: //doi.org/10.3109/01612840.2010.548906
- [14] Alan Cooper. 1999. The inmates are running the asylum. In Software-Ergonomie'99. Springer Vieweg Verlag, Wiesbaden, Ger, 17–17.
- [15] Don E Davis, Cirleen DeBlaere, Jesse Owen, Joshua N Hook, David P Rivera, Elise Choe, Dan R Van Tongeren, Everett L Worthington Jr, and Vanessa Placeres. 2018. The multicultural orientation framework: A narrative review. *Psychotherapy* 55, 1 (2018), 89. https://doi.org/10.1037/pst0000160
- [16] Daniel Eisenberg, Sarah E Gollust, Ezra Golberstein, and Jennifer L Hefner. 2007. Prevalence and correlates of depression, anxiety, and suicidality among university students. *American journal of orthopsychiatry* 77, 4 (2007), 534–542.
- [17] A Fernandez, E Howse, M Rubio-Valera, K Thorncraft, J Noone, X Luu, B Veness, M Leech, G Llewellyn, and L Salvador-Carulla. 2016. Setting-based interventions to promote mental health at the university: a systematic review. International journal of public health 61, 7 (2016), 797–807. https://doi.org/10.1007/s00038-016-0846-4
- [18] Emmanouil Giannisakis, Jessalyn Alvina, Andrea Bunt, Parmit Chilana, and Joanna McGrenere. 2021. Promoting Feature Awareness by Leveraging Collaborators' Usage Habits in Collaborative Editors. In *Graphics Interface 2022* (Montreal, Quebec, CA). Canadian Human-Computer Communications Society (CHCCS), Waterloo, CA.
- [19] Gordon CN Hall, Janie J Hong, Nolan WS Zane, and Oanh L Meyer. 2011. Culturally competent treatments for Asian Americans: The relevance of mindfulness and acceptance-based psychotherapies. *Clinical Psychology: Science and Practice* 18, 3 (2011), 215. https://doi.org/10.1111/j.1468-2850.2011.01253.x
- [20] Jennifer Hefner and Daniel Eisenberg. 2009. Social support and mental health among college students. American Journal of Orthopsychiatry 79, 4 (2009), 491–499. https://doi.org/10.1037/a0016918
- [21] Wille J Heggins and Jerlando FL Jackson. 2003. Understanding the collegiate experience for Asian international students at a Midwestern research university. *College Student Journal* 37, 3 (2003), 379–392. https://psycnet.apa.org/record/2003-07646-007
- [22] Jennifer Huberty, Jeni Green, Christine Glissmann, Linda Larkey, Megan Puzia, Chong Lee, et al. 2019. Efficacy of the mindfulness meditation mobile app "calm" to reduce stress among college students: Randomized controlled trial. JMIR mHealth and uHealth 7, 6 (2019), e14273. https://doi.org/10.2196/14273
- [23] Jenny Hyun, Brian Quinn, Temina Madon, and Steve Lustig. 2007. Mental health need, awareness, and use of counseling services among international graduate students. *Journal of American College Health* 56, 2 (2007), 109–118. https://doi.org/10.3200/JACH.56.2.109-118
- [24] Gather Presence Inc. 2022. Gather. Retrieved May 1, 2022 from https://www.gather.town/
- [25] Amar Kanekar, Manoj Sharma, and Ashutosh Atri. 2010. Enhancing social support, hardiness, and acculturation to improve mental health among Asian Indian international students. *International Quarterly of Community Health Education* 30, 1 (2010), 55–68. https://doi.org/10.2190/IQ.30.1.e
- [26] Christina Kelley, Bongshin Lee, and Lauren Wilcox. 2017. Self-Tracking for Mental Wellness: Understanding Expert Perspectives and Student Experiences. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (Denver, Colorado, USA) (*CHI '17*). Association for Computing Machinery, New York, NY, USA, 629–641. https://doi.org/10.1145/3025453.3025750
- [27] Ryan M. Kelly, Yueyang Cheng, Dana McKay, Greg Wadley, and George Buchanan. 2021. "It's About Missing Much More Than the People": How Students Use Digital Technologies to Alleviate Homesickness. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (Yokohama, Japan) (CHI '21). Association for Computing Machinery, New York, NY, USA, Article 226, 17 pages. https://doi.org/10.1145/3411764.3445362
- [28] Heejung S Kim, David K Sherman, and Shelley E Taylor. 2008. Culture and social support. American psychologist 63, 6 (2008), 518. https://doi.org/10.1037/0003-066X
- [29] Kurt Kroenke, Robert L Spitzer, and Janet BW Williams. 2001. The PHQ-9: validity of a brief depression severity measure. Journal of general internal medicine 16, 9 (2001), 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x
- [30] Emily G. Lattie, Rachel Kornfield, Kathryn E. Ringland, Renwen Zhang, Nathan Winquist, and Madhu Reddy. 2020. Designing Mental Health Technologies That Support the Social Ecosystem of College Students. In *Proceedings of the* 2020 CHI Conference on Human Factors in Computing Systems. Association for Computing Machinery, New York, NY, USA, 1–15. https://doi.org/10.1145/3313831.3376362
- [31] Xiaoqian Li and Wenhong Chen. 2014. Facebook or Renren? A comparative study of social networking site use and social capital among Chinese international students in the United States. *Computers in Human Behavior* 35 (2014), 116–123. https://doi.org/10.1016/j.chb.2014.02.012
- [32] Luo Lu. 1994. University transition: Major and minor life stressors, personality characteristics and mental health. Psychological medicine 24, 1 (1994), 81–87. https://doi.org/10.1017/S0033291700026854

- [33] Arati Maleku, Youn Kyoung Kim, Jaclyn Kirsch, Mee Young Um, Hanna Haran, Mansoo Yu, and Sung Seek Moon. 2022. The hidden minority: Discrimination and mental health among international students in the US during the COVID-19 pandemic. *Health & social care in the community* 30, 5 (2022), e2419–e2432.
- [34] Steve Mathias, Karen Tee, Warren Helfrich, Krista Gerty, Godwin Chan, and Skye Pamela Barbic. 2022. Foundry: Early learnings from the implementation of an integrated youth service network. *Early Intervention in Psychiatry* 16, 4 (2022), 410–418. https://doi.org/10.1111/eip.13181
- [35] Jonathan F Mattanah, Jean F Ayers, Bethany L Brand, Leonie J Brooks, Julie L Quimby, and Scot W McNary. 2010. A social support intervention to ease the college transition: Exploring main effects and moderators. *Journal of college* student development 51, 1 (2010), 93–108. https://doi.org/10.1353/csd.0.0116
- [36] Sharon L Mitchell, Mahrin Kader, Melinda Z Haggerty, Yogesh D Bakhai, and Calvert G Warren. 2013. College student utilization of a comprehensive psychiatric emergency program. *Journal of College Counseling* 16, 1 (2013), 49–63. https://doi.org/10.1002/j.2161-1882.2013.00026.x
- [37] Catherine Montgomery and Liz McDowell. 2009. Social Networks and the International Student Experience: An International Community of Practice? *Journal of Studies in International Education* 13, 4 (2009), 455–466. https: //doi.org/10.1177/1028315308321994
- [38] Sakurako Chako Mori. 2000. Addressing the mental health concerns of international students. Journal of counseling & development 78, 2 (2000), 137–144. https://doi.org/10.1002/j.1556-6676.2000.tb02571.x
- [39] Michael J Muller and Sarah Kuhn. 1993. Participatory design. Commun. ACM 36, 6 (1993), 24–28. https://doi.org/10. 1145/153571.255960
- [40] Elizabeth L. Murnane, Tara G. Walker, Beck Tench, Stephen Voida, and Jaime Snyder. 2018. Personal Informatics in Interpersonal Contexts: Towards the Design of Technology That Supports the Social Ecologies of Long-Term Mental Health Management. Proc. ACM Hum.-Comput. Interact. 2, CSCW, Article 127 (nov 2018), 27 pages. https: //doi.org/10.1145/3274396
- [41] Sumin Na, Andrew G. Ryder, and Laurence J. Kirmayer. 2016. Toward a Culturally Responsive Model of Mental Health Literacy: Facilitating Help-Seeking Among East Asian Immigrants to North America. *American Journal of Community Psychology* 58, 1-2 (2016), 211–225. https://doi.org/10.1002/ajcp.12085 arXiv:https://onlinelibrary.wiley.com/doi/pdf/10.1002/ajcp.12085
- [42] Timothy Neate, Aikaterini Bourazeri, Abi Roper, Simone Stumpf, and Stephanie Wilson. 2019. Co-Created Personas: Engaging and Empowering Users with Diverse Needs Within the Design Process. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (Glasgow, Scotland Uk) (CHI '19). Association for Computing Machinery, New York, NY, USA, 1–12. https://doi.org/10.1145/3290605.3300880
- [43] Larry J Nelson and Carolyn McNamara Barry. 2005. Distinguishing features of emerging adulthood: The role of selfclassification as an adult. *Journal of adolescent research* 20, 2 (2005), 242–262. https://doi.org/10.1177/0743558404273074
- [44] Frank Neri and Simon Ville. 2008. Social capital renewal and the academic performance of international students in Australia. *The Journal of Socio-Economics* 37, 4 (2008), 1515–1538. https://doi.org/10.1016/j.socec.2007.03.010
- [45] Fatih Ozbay, Douglas C Johnson, Eleni Dimoulas, CA Morgan III, Dennis Charney, and Steven Southwick. 2007. Social support and resilience to stress: from neurobiology to clinical practice. *Psychiatry (Edgmont)* 4, 5 (2007), 35–40. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2921311/
- [46] Sun Young Park. 2018. Social Support Mosaic: Understanding Mental Health Management Practice on College Campus. In Proceedings of the 2018 Designing Interactive Systems Conference (Hong Kong, China) (DIS '18). Association for Computing Machinery, New York, NY, USA, 121–133. https://doi.org/10.1145/3196709.3196787
- [47] Scott B. Patten. 2017. Age of Onset of Mental Disorders. The Canadian Journal of Psychiatry 62, 4 (2017), 235–236. https://doi.org/10.1177/0706743716685043
- [48] Sachin R. Pendse, Kate Niederhoffer, and Amit Sharma. 2019. Cross-Cultural Differences in the Use of Online Mental Health Support Forums. Proc. ACM Hum.-Comput. Interact. 3, CSCW, Article 67 (Nov. 2019), 29 pages. https: //doi.org/10.1145/3359169
- [49] Claudette Pretorius, Darragh McCashin, Naoise Kavanagh, and David Coyle. 2020. Searching for Mental Health: A Mixed-Methods Study of Young People's Online Help-Seeking. Association for Computing Machinery, New York, NY, USA, 1–13. https://doi.org/10.1145/3313831.3376328
- [50] John Pruitt and Tamara Adlin. 2010. The persona lifecycle: keeping people in mind throughout product design. Morgan Kaufmann Publishers, Burlington, MA, USA.
- [51] Xi Rao and Libby Hemphill. 2016. Asian American Chicago Network: A Case Study of Facebook Group Use By Immigrant Groups. In Proceedings of the 19th ACM Conference on Computer Supported Cooperative Work and Social Computing Companion (San Francisco, California, USA) (CSCW '16 Companion). Association for Computing Machinery, New York, NY, USA, 381–384. https://doi.org/10.1145/2818052.2869077
- [52] Kristen A Renn. 2003. Understanding the identities of mixed-race college students through a developmental ecology lens. Journal of college student development 44, 3 (2003), 383–403. https://doi.org/10.1353/csd.2003.0032

Proc. ACM Hum.-Comput. Interact., Vol. 7, No. CSCW2, Article 258. Publication date: October 2023.

- [53] Cindy C Sangalang and Gilbert C Gee. 2012. Depression and anxiety among Asian Americans: The effects of social support and strain. Social work 57, 1 (2012), 49–60. https://doi.org/10.1093/sw/swr005
- [54] Kosuke Sato, Masaki Yuki, and Vinai Norasakkunkit. 2014. A socio-ecological approach to cross-cultural differences in the sensitivity to social rejection: The partially mediating role of relational mobility. *Journal of Cross-Cultural Psychology* 45, 10 (2014), 1549–1560.
- [55] Helen Sawaya, Mia Atoui, Aya Hamadeh, Pia Zeinoun, and Ziad Nahas. 2016. Adaptation and initial validation of the Patient Health Questionnaire–9 (PHQ-9) and the Generalized Anxiety Disorder–7 Questionnaire (GAD-7) in an Arabic speaking Lebanese psychiatric outpatient sample. *Psychiatry research* 239 (2016), 245–252. https: //doi.org/10.1016/j.psychres.2016.03.030
- [56] Erlenawati Sawir, Simon Marginson, Ana Deumert, Chris Nyland, and Gaby Ramia. 2008. Loneliness and international students: An Australian study. *Journal of studies in international education* 12, 2 (2008), 148–180. https://doi.org/10. 1177/1028315307299699
- [57] Sang-Wha Sien, Shalini Mohan, and Joanna McGrenere. 2022. Exploring Design Opportunities for Supporting Mental Wellbeing Among East Asian University Students in Canada. In CHI Conference on Human Factors in Computing Systems (New Orleans, LA, USA) (CHI '22). Association for Computing Machinery, New York, NY, USA, Article 330, 16 pages. https://doi.org/10.1145/3491102.3517710
- [58] Robert L. Spitzer, Kurt Kroenke, Janet B. W. Williams, and Bernd Löwe. 2006. A Brief Measure for Assessing Generalized Anxiety Disorder: The GAD-7. Archives of Internal Medicine 166, 10 (05 2006), 1092–1097. https://doi.org/10.1001/ archinte.166.10.1092 arXiv:https://jamanetwork.com/journals/jamainternalmedicine/articlepdf/410326/ioi60000.pdf
- [59] Eloise Stark, Dorota Ali, Annalise Ayre, Naomi Schneider, Sophia Parveen, Keith Marais, Nick Holmes, and Richard Pender. 2021. Coproduction with autistic adults: Reflections from the authentistic research collective. Autism in Adulthood 3, 2 (2021), 195–203.
- [60] Franziska Tachtler, Toni Michel, Petr Slovák, and Geraldine Fitzpatrick. 2020. Supporting the Supporters of Unaccompanied Migrant Youth: Designing for Social-Ecological Resilience. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems. Association for Computing Machinery, New York, NY, USA, 1–14. https://doi.org/10.1145/3313831.3376458
- [61] Charlotte Tang, Xinning Gui, Yunan Chen, and Mohamed Magueramane. 2018. New to a Country: Barriers for International Students to Access Health Services and Opportunities for Design. In *Proceedings of the 12th EAI International Conference on Pervasive Computing Technologies for Healthcare* (New York, NY, USA) (*PervasiveHealth '18*). Association for Computing Machinery, New York, NY, USA, 45–54. https://doi.org/10.1145/3240925.3240969
- [62] Shelley E Taylor, David K Sherman, Heejung S Kim, Johanna Jarcho, Kaori Takagi, and Melissa S Dunagan. 2004. Culture and social support: Who seeks it and why? *Journal of personality and social psychology* 87, 3 (2004), 354. https://doi.org/10.1037/0022-3514.87.3.354
- [63] Ralph Vacca. 2017. Bicultural: Examining Teenage Latinas' Perspectives on Technologies for Emotional Support. In Proceedings of the 2017 Conference on Interaction Design and Children (Stanford, California, USA) (IDC '17). Association for Computing Machinery, New York, NY, USA, 117–126. https://doi.org/10.1145/3078072.3079742
- [64] Francesco Vitale, William Odom, and Joanna McGrenere. 2019. Keeping and Discarding Personal Data: Exploring a Design Space. In Proceedings of the 2019 on Designing Interactive Systems Conference (San Diego, CA, USA) (DIS '19). Association for Computing Machinery, New York, NY, USA, 1463–1477. https://doi.org/10.1145/3322276.3322300
- [65] Christine J Yeh and Mayuko Inose. 2003. International students' reported English fluency, social support satisfaction, and social connectedness as predictors of acculturative stress. *Counselling Psychology Quarterly* 16, 1 (2003), 15–28. https://doi.org/10.1080/0951507031000114058
- [66] Renwen Zhang, Jordan Eschler, and Madhu Reddy. 2018. Online support groups for depression in China: Culturally shaped interactions and motivations. *Computer Supported Cooperative Work (CSCW)* 27, 3 (2018), 327–354. https: //doi.org/10.1007/s10606-018-9322-4
- [67] Yan Zhou, Jing Xu, and Winfried Rief. 2020. Are comparisons of mental disorders between Chinese and German students possible? An examination of measurement invariance for the PHQ-15, PHQ-9 and GAD-7. *Bmc Psychiatry* 20, 1 (2020), 1–11. https://doi.org/10.1186/s12888-020-02859-8

# A STORYBOARD 1

258:24



Fig. 5. Storyboard 1, Dinner Party.

# B STORYBOARD 2





# C STORYBOARD 4



Fig. 7. Storyboard 4, AI Counsellor.

Received July 2022; revised January 2023; accepted March 2023