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Application of the CeHRes Framework to the Development of Pathway: An HCI Perspective

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ABSTRACT

Mental health difficulties are highly prevalent among young people. Despite this, research shows that many young people do not seek help for mental health difficulties. In this paper, we explore the experiences of students who have accessed mental health support services in Ireland. Their experiences highlight the barriers students face while accessing mental health support. We found that students lack access to the necessary information to support their decision-making process when selecting a support service. For instance, how a service operates, what kind of support a service provides, the privacy policies, etc. Based on these identified needs, we designed a prototype of an application called Pathway. Pathway aims to address these barriers by providing students with mental health support services that fit their preferences. It also provides detailed information on mental health support services. This paper details the use of the eHealth development framework by the Center for eHealth Research and Disease Management towards the development of this application.

CCS CONCEPTS

• **Human-centered computing → User studies**.

KEYWORDS

Mental Health, Help-Seeking, University Students, Participatory Design, eHealth Development Framework

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1 INTRODUCTION

There is an increasing prevalence of mental health difficulties among young people [2, 19]. An international survey conducted by the World Health Organisation revealed that 35% of first-year college students screened positive for anxiety, depression or substance use disorder [3]. Despite this, young people are unlikely to seek professional mental health support[2, 13, 19]. Barriers to the use of mental health support include lack of perceived need for support [12], stigma [17], lack of mental health literacy [12, 35], doubts about the effectiveness of treatment [12, 35], lack of time [12] etc. Several solutions have been proposed to reduce the mental health treatment gap in this population. These include stigma reduction programs [13], mental health literacy programs [13], screening services [13], gatekeeper training [13, 35] and the use of technological interventions [24].

However, there is limited research on the demand and supply of mental health resources in universities and communities [12, 19]. It is important to examine whether students who seek mental health support are able to access the necessary support. As mentioned earlier, technological interventions have been proposed as a means of improving access to mental health support in this population. A review of technological interventions revealed that they are effective in reducing symptoms of anxiety and depression and increasing mental well-being in this population [24]. However, users tend to quickly discontinue their use of these interventions [24]. Alquatani et. al [1] conducted a review of mental health apps in the App Store and Google Play Store. They found that poor visual design, presence of bugs within an app, lack of trust, security and privacy concerns, lack of personalization, the proliferation of ads, and lack of customer service were barriers to long-term use of mental health apps [1]. Digital mental health interventions are more likely to be effective when they align with users' needs and expectations [18, 21, 39].

The Center for eHealth Research and Disease Management (CeHRes) [21] proposed a holistic framework for the development of eHealth interventions. This framework was developed based on a review of existing eHealth frameworks, and it aims to improve the uptake and impact of eHealth interventions. The CeHRes framework is guided by three main principles: 1) eHealth development is a participatory process that should involve stakeholders (e.g. clinicians, end-users, caretakers, etc.) throughout the development process 2) eHealth development is an iterative process that should be continuously evaluated from the perspective of stakeholders 3) eHealth development should include persuasive design techniques to keep users engaged and to encourage behaviour change where appropriate.

In this project, we applied the CeHRes framework in the development of a digital intervention which aims to address the mental health treatment gap for students at University College Cork in Ireland. The aims of this project were to 1) understand the experiences of students who have/have not sought mental health support 2) explore the use of technological intervention in reducing barriers to accessing mental health support in this population. 3) apply a user-centred design in the development of any such intervention.

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2 APPROACH

2.1 CeHRes Framework

The eHealth development framework by the Center for eHealth Research and Disease Management is based on principles from participatory design, human-centred design, persuasive design and business modelling [21]. The authors posit that the development of eHealth technologies should take place in five iterative phases including contextual inquiry, value specification, design, operationalization and summative evaluation.

Contextual Inquiry. The first phase of the CeHRes framework aims to understand the context in which the technology will be developed. An understanding of the user's current context and the underlying difficulties they face will help identify if or how technology can support users [21]. In this project, the contextual inquiry was conducted in three stages. Firstly, we conducted desk research and liaised with mental health researchers in order to establish the context of this research. Next, we conducted a survey to understand the prevalence of mental health difficulties in this population, their help-seeking behaviours, their use of mental health support services and their use of technological supports. Further, we conducted a scoping review to explore how user-centred design methods have been applied in the development of mental health technologies for this population. Finally, the CeHRes framework emphasises the need for a multidisciplinary team to ensure that those with the needed expertise contribute to the development of eHealth technology. As a result, during the design of the survey and scoping review, we consulted with mental health researchers.

Value specification. Value specification brings together the issues identified in the contextual inquiry. It should help identify the issues that can be addressed using technology [21]. The outcomes of the value specification for this project were identifying content requirements (i.e. what kind of information should the technology offer its users), usability and user experience requirements (i.e. existing preferences that users have about this kind of technology) and functional and modality requirements (i.e. what modalities should the technology operate in, for example, on Android and Apple operating systems) [21].

Design. The design phase involves the development of low-fidelity and high-fidelity prototypes. These prototypes are a representation of the final product or technology. The purpose of creating early prototypes is to ensure that they represent a user's mental model and meet their needs and expectations [21]. In this project, we developed low-fidelity and high-fidelity prototypes. Design guidelines (e.g. spacing, text sizes, icons, etc.) from the open-source Patternfly library [31] were used to inform the initial design of Pathway.

Operationalisation. During the operationalisation phase of the CeHres roadmap, the necessary steps are taken to ensure the seamless integration of eHealth technology into the intended context [21]. This phase is out of the scope of this paper.

Summative evaluation. The summative evaluation phase aims to assess the impact of the technology on the health and well-being of its users and to assess how the technology is used in its context over a period of time [21]. The Pathway implementation is currently in the prototype stage, therefore, we are conducting formative evaluations to assess whether end-users and experts consider Pathway useful and easy-to-use [25]. These evaluations are conducted in the form of iterative usability tests [22].

3 FINDINGS

The findings are organised according to the phases of the CeHRes framework. We discuss how each phase was applied to this project, the operationalisation phase is not discussed as it is outside the scope of this paper. The findings in this study are organised as follows: section 3.1 - Contextual Inquiry; section 3.2 - Value specification; section 3.3 - Design; and section 3.4 - Summative evaluation.

3.1 Contextual Inquiry

3.1.1 Stakeholder identification. A stakeholder is any group or individual that can affect or is affected by the creation of eHealth Technology [15]. Initial desk research on mental health in higher education revealed potential stakeholders in this population. In this context, the term "stakeholders" refers to individuals who participate in mental health research for this population, as well as those who offer support to young adults. They include students [5, 27, 37], youth in the general population[9, 10], disability advisors [37], counselling services [9, 10, 20], mental health support workers [37], GPs [9, 10] and mental health support services [9, 10, 33]. A scoping review [29] on online mental health interventions designed for students in higher education found that stakeholders included in these studies included students, youth in the general population, university staff, student union representatives, and university counselling service staff.

Our project is focused on using University College Cork students as a case study. Therefore, we included stakeholders who we believed contributed to students' mental health through signposting or providing mental health support. These include students (as potential end-users), student union representatives, student counselling services and disability support services.

We conducted interviews with student union representatives and the disability support service. It was not possible to conduct interviews with the counselling services. The interview with the disability support service explored the interviewee's role within the service, the challenges they faced in supporting students before and during the pandemic, student engagement with the service during the pandemic and the changes they would like to see in supporting students.

During the interview with the student union, we discussed how the service supports students with mental health difficulties. We explored the accessibility of the counselling service website, the mental health initiatives promoted by the student union through social media, the challenges faced in supporting students during the pandemic and the improvements that can be made in the University's provision of mental health support to students.

3.1.2 Online surveys. Our anonymous online survey explored the prevalence of mental health difficulties during the COVID-19 pandemic. Respondents (N=452) were asked what forms of support they had used for their mental health. They were also asked to discuss their experiences accessing and receiving mental health support.

Finally, they were asked to discuss their experiences using technological support. The online survey was crucial in the development of Pathway by 1) identifying barriers students face while accessing mental health support services in Ireland and 2) exploring factors influencing their use of technological support. A paper detailing students' experiences with technological support has recently been published [30]. Another paper outlining students' experiences with mental health support services is currently under review.

3.2 Value Specification

3.2.1 Content requirements for Pathway. The content requirements for Pathway were produced through the online survey identifying barriers students face while accessing mental health support services in Ireland. In this study, we focus on the barriers that we believe can be addressed using technology. Table 1 provides a summary of the requirements, barriers related to each requirement and illustrative quotes from survey respondents.

External validation of students' need for mental health support. Respondents in our survey expressed concern that using a mental health support service, mainly, the university counselling service, would prevent others (who may need it more) from having access to the service. They also felt that the difficulties they were experiencing were not serious enough to warrant professional support. These findings are closely related to other studies which identified self-reliance as one of the main barriers to help-seeking among college students [11, 17]. Research has also shown that young people who seek help are likely influenced by people they know e.g. friends, teachers, partners, etc. [35, 40]. In Pathway, we included a well-being assessment that utilises the WHO-5 well-being questionnaire [42]. The reason for including this questionnaire is to help validate students' need for mental health support by providing an objective assessment of their well-being.

Information on how a service operates. Respondents in our survey indicated that they did not have information on how the service operated prior to using the service. They mentioned having counsellors change from one session to another. They also note that there was a limit on the number of sessions they could attend. We understand that some services have limited funding and need to operate this way. However, we believe it is crucial for students to have access to this information before using a service. As a result, students using Pathway will have access to this information.

Allow students to select their preferred mental health support services. As with previous research [17], we found that the cost of counselling/therapy was a barrier to accessing support. In addition, respondents mentioned that they preferred face-to-face support instead of online support. Previous studies [20, 32] have revealed that students have differing views on the use of online and face-to-face support. Further, respondents pointed out that the counselling/therapy methods used were not compatible with their needs (*The counsellor was nice but I think CBT was the wrong therapy for me. [P114]*).
These findings indicate that students already have their preferences regarding mental health support services. To address this, Pathway includes a survey asking students about their preferences. Upon completion, the student will receive a list of services that match their preferences (i.e. in terms of cost, counselling methods, online v face to face services, and formal/informal services). For instance, if a student prefers online services with a maximum cost of 50 euro per session, they will be provided with a list of services that meet those criteria.

Information on support services. Respondents found that there was a mismatch between their expectations about the role of a support service and its actual role. For example, respondents felt that the Disability Support Service within the University did not prioritise mental health. However, during our interview with the service, it was clarified that the role of this service was to signpost students towards counselling services rather than to provide direct support for mental health concerns.
The importance of privacy in mental health support services for this population has been highlighted by previous studies [29, 34]. In this study, respondents feared that their mental health information would be revealed to future employers. Further, respondents mentioned that they were asked to send an email to the entire unit if they had an issue. As a result, they were not sure who would have access to such sensitive information. It is clear that mental health support services need to be transparent about how data is shared within and outside of a service.
In addition, respondents mentioned that they were not aware of the available support services, and when they became aware of them, it was unclear what steps to take in order to schedule an appointment with the service.
To address these issues, Pathway provides students with a verified description of mental health support services, the kind of support they provide (e.g. depression, anxiety, etc), their privacy policies, and a step-by-step guide on how to schedule an appointment with a service.

Up-to-date reviews of students' experiences with support services. As mentioned earlier, young people are often positively influenced by their peers to seek mental health support [40]. In this study, we found that negative stories and experiences about mental health support services were shared within social circles. This was a barrier to the use of certain mental health support services. While these stories and experiences hold true, we believe that support services are in constant flux, and may have improved since they were last used. As a result, Pathway provides recent reviews of students' experiences with mental health support services. We believe that these reviews will help students make better-informed decisions about what services to attend.

Table 1: Content requirements for Pathway

Requirements	Barriers related to requirement	Illustrative quotes
The application should provide an external validation of students' need for mental health support	• Concern for others • Feeling that case was not serious enough	I feel hesitant to reach out to support services that I feel are overloaded with requests [P474] I didn't think my episode was severe enough for counselling etc [P121]
The application should provide information on how a service operates	• Changing counsellors • Limited number of sessions	I did not see it as a long-term solution at the time as they changed who I was speaking to from one session to another and I found it difficult to get to know a new counsellor each time [P17] The number of counselling sessions I was offered was not adequate. [P424]
The application should allow students to select their preferred mental health support services	• Cost of accessing services • Preference for face to face support • No online support offered • Incompatibility with counselling methods	I can't afford to go to therapy or counselling, it's too expensive and I'm only earning part-time. Either pay rent or pay for therapy. [P395] I would have liked additional support but with no face to face meeting, I did not want to do video calls [P15]
The application should provide information on support services including privacy policies, how to access services, and the kinds of support offered by a service.	• Lack of information on services available • Privacy (future employers) • Privacy (in service) • Difficulty accessing appointments • No focus on mental health • Unaware of the kind of support a service provides • Help provided was inadequate	Vague, prefer to have all connections and contacts of mental help all in one place and easily accessible [P223] I don't feel comfortable having it on file potentially for future employers to find out without my express wish to disclose that information. [P366]
The application should provide up-to-date reviews of students experiences with support services	• Negative expectations of service	I personally haven't made use of any of the services but I've heard that there's a ridiculously long waiting list for counselling and that even once you do get an appointment, some people aren't happy with the experience/competence of the counsellors [P397]

3.2.2 Usability and user experience requirements. The usability and user experience requirements for Pathway were derived from two main sources, the online survey and the scoping review. In the online survey, students were asked to discuss their experiences with the use of technological resources to support their mental health [30]. Their responses allowed us to compile a list of factors that influence their use of these tools.
The scoping review explored online mental health interventions designed for students in higher education which applied a user-centred perspective [29]. Through these studies, we produced a list of students' needs in relation to these interventions.

Information requirements for Pathway. Study participants in the scoping review studies [7, 8, 14] and the survey [30] emphasised the need for online resources to provide trustworthy information (*I found the HSE website very useful as all the information is clear and concise. It is reliable information. [P403]*). Participants felt that texts within the application should be short. They noted that long texts were difficult to go through when they were feeling down (*"Reduce the text aspect of the programme as much as possible. When I was feeling especially depressed, the last thing I felt capable of doing was reading through long passages. That felt like homework."*) [8]. Finally, they noted that information should be presented in a non-judgemental and non-patronising manner (*I found the UCC mental health page a bit condescending in its approach of "here's a good quote for today" when what I needed at the time was resources [P125]*). Pathway meets these requirements by including verified information about mental health support services. When this is not possible, users are made aware of the source of the information. Also, Information is presented with short sentences and progressive disclosure is used to ensure that users are not overwhelmed by the amount of information on a given screen.

Anonymity. Participants in the scoping review studies [8, 14, 16] felt that anonymity would protect them from mental health stigma and allow them to share their issues more openly (*There's no stigma because nobody knows I'm kind of going on there.* [14]). They also felt that online applications should allow the use of anonymous log-ins for those who did not want to sign up (*I think it's important to have your username account but also a guest account so if you don't want to do something which someone else can see, you can use the private guest account, which won't record your information.* [16]). To meet these requirements, users of Pathway do not have to create an account to use the application.

Privacy. Participants in the scoping review studies felt that applications should only collect necessary information. They suggested avoiding or making optional potentially identifying information, such as date of birth and area of study [16]. In addition, participants mentioned that privacy policies for online applications should be straightforward (*Short and succinct... not too lengthy, 'cause as soon as it becomes more than like a paragraph, no one reads it* [16]). Participants also expressed concerns over how their data might be shared (*...maybe some people want to make certain things private. Like I don't want people knowing how much I'm [sic] sleep. It would be a good idea to allow for that so people can make it function that way.*)[28]. On the home screen of Pathway, users are provided with brief information on how their data is processed. No personal information is collected within the application.

User safety. Scoping review participants raised concerns about the security of an online resource, and whether their conversations might be recorded (*I'm actually more than willing to put in every single thing as long as I know that the whole system is safe.*)[16]. They also felt that anonymity could jeopardise safety in online forums (*people will be trolling the boards and I feel like it's always hurtful. And even if their privacy is maintained, just hearing those things from other people in an environment that you've made yourself vulnerable in, I feel like would be even more damaging.*) [14]. Pathway is currently in the prototype stage, but user safety will be a priority during its development.

Simplicity. Survey participants appreciated the simplicity and ease of use of mental health apps (*It's a nice simple app... I love it cause it's simple - you literally just list things you felt grateful for that day. [P323]*) [30]. Ease of use and simplicity were prioritised in the design of Pathway.

Personalization. Participants in the scoping review [6, 14] and the survey indicated a desire for online applications that are customized for students (*I enrolled with UCC Participate. It is a really great resource for students [P236]*) [30] and include personalized pacing and exercise structure (*Well, one of my roommates and I, like we both are trying to get into meditation, but we have very different styles. Like, for me, I prefer like a guided meditation that talks about sensation, . . . whereas she prefers more like, a visualisation, like imagine yourself on a beach, kind of thing . . . so having, again, those options.*)[14]. Pathway is designed based on students' needs, and usability tests are being conducted to ensure that we understand their mental models of seeking mental health support.

Description of purpose. Participants in the survey reported struggling to find online resources that were relevant (*I have also found Instagram great for learning about mental health issues and how to deal with them. And I sometimes watch self care vids on YouTube, but can be hard to find good ones, a lot are kinda the same. [P323]*)[30]. We hypothesized that including a clear description of the purpose of each online resource would make it easier for users to select relevant resources. The home screen of Pathway provides a short description of the app and its features.

Paywalls. Survey participants noted that they sometimes had limited access to online resources as a result of paywalls (*Helpful, but for most of the apps there was only a free trial so didn't use it for a long time[P336]*) [30].
We will ensure that students will be able to access Pathway free of charge.

Visual design. In discussing their experiences with online resources, survey participants noted the importance of a visually appealing user interface (*The NHS CBT site is helpful but I didn't complete the whole course, it was so ugly to look at lol [P302]*) [30]. Similarly, participants in the scoping review studies mentioned that changes should be made to navigation, font sizes, colours and layout of the screen (*Not initially easy to figure out. Colour is not appealing.*)[36].

We have ensured that Pathway's visual design is consistent throughout the application. The colours have been carefully chosen to meet accessibility guidelines [41] and the navigation is straightforward. Patternfly [31] guidelines were also used to inform the design.

Useful in urgent situations. Survey participants found it helpful for online resources to provide support whenever they needed it (*I have used online resources during very bad periods. Three years ago I frequently phoned the Samaritans when I was considering suicide. I found this helpful. [P176]*) [30].
Similarly, the importance of including national emergency hotlines in mental health apps has been noted in previous studies [1]. As a result, the home screen of Pathway includes the phone numbers for emergencies in Ireland, and the application also includes information on how to get urgent help.

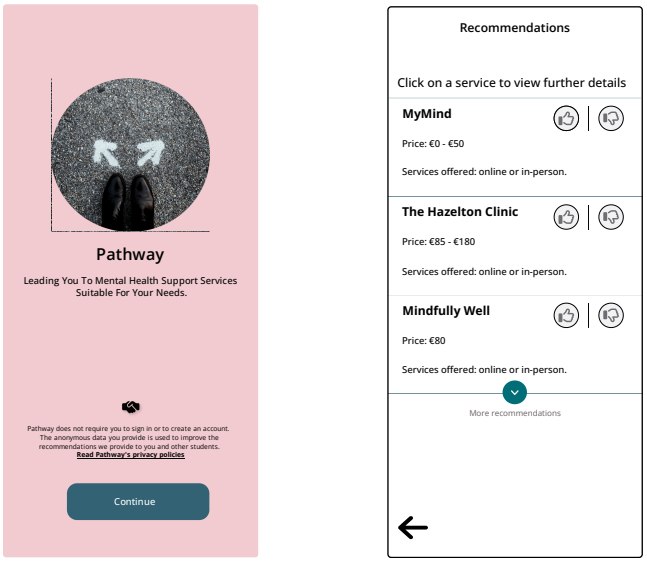
Engaging content. Scoping review participants felt that online mental health resources should be engaging and enjoyable [6]. In addition, they felt that the completion of mental health questionnaires should be voluntary (*I think if you could have like a pop-up quiz...'we'd like to invite you to fill in this short quiz–it's entirely up to you whether to fill it in or not,' because I think that matter of choice is important. Don't shove it down their throat*)[16]. Although the WHO-5 well-being survey [42] is included in Pathway, its completion is voluntary.

3.2.3 Modality requirements for Pathway. Pathway is designed as a web application that can be assessed via mobile and desktop devices. Users of Pathway will not need to download/install it.

3.3 Design

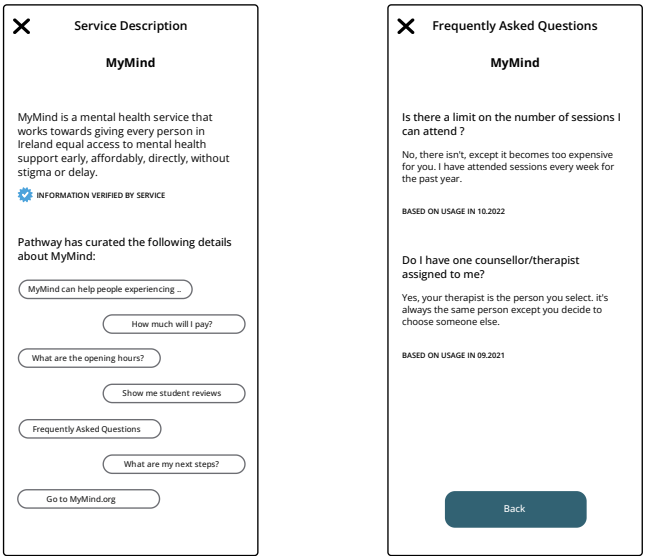
3.3.1 Pathway. The design of Pathway's high-fidelity prototype is guided by the aforementioned content requirements and usability requirements. The aim of Pathway is to streamline the process of searching for mental health support by providing tailored information based on each student's preferences. As a result, the use of Pathway will help reduce the time it takes students from deciding to seek help to actively using mental health support services. Pathway, shown in Figure 1 - 2, has three main features:

(1) It provides students with a mental well-being score which is based on the WHO-5 well-being questionnaire [38].
(2) The application allows students to input their preferences (if any) regarding mental health support services. These preferences include a price range, formal(i.e. run by mental health professionals) or informal services (i.e. run by volunteers), counselling/therapy approach (e.g. Cognitive Behavioural Therapy, Person-Centered Therapy, etc.), and online or face-to-face services. Following the selection of preferences, students will be given a list of recommended support services that fit their chosen preferences.
(3) Finally, upon the selection of a service they will be shown information on that service. This includes a short description of the service, the kind of support they provide (e.g. depression, anxiety, etc), the cost of accessing a service, its opening hours, student reviews, frequently asked questions, a step-by-step guide on how to schedule an appointment with a service and a link to the service website.



(a) Home screen **(b) Recommended services**

Figure 1: Screens from the Pathway Prototype



(a) Sample service description **(b) Frequently asked questions**

Figure 2: Screens from the Pathway Prototype

3.4 Summative Evaluation

3.4.1 Usability testing. Usability testing is the evaluation of a system by representative users [23]. The aims of a usability test are to ensure that a system is usable (i.e. easy to learn/use) and fits the needs of its target population [26]. An iterative usability test is carried out in cycles and in between these cycles the prototype is redesigned based on users' interaction with the system[22]. We have received ethical approval from the Social Research Ethics

Committee (Log 2023-048A2) to conduct iterative usability tests on Pathway. As mentioned earlier, students and staff (in the School of Applied Psychology at University College Cork with experience in the design of mental health technology) will be interacting with the Pathway prototype. The aims of the study are to:

(1) Improve the current prototype to match end-users' needs and mental model of searching for mental health support
(2) To gain a better understanding of the current methods of searching for support
(3) Evaluate the usability (i.e. ease of use, navigation, and clarity of language) and acceptability of Pathway

Participants. Prior to this study, a preliminary usability test was conducted with a youth advisory group and an expert in user experience. Their feedback was used to improve the initial prototype. The current study is ongoing, however, we have conducted usability tests with two academic staff and one student. The inclusion criteria for students are 1) aged 18 years or older 2) currently a student at University College Cork, Ireland 3) has privacy to speak freely during the session 4) has access to the computer and the internet. Students are currently being recruited via mailing lists, social media and posters placed around the University campus. Academic staff in the School of Applied Psychology were contacted directly via email. We intend to conduct two cycles of usability tests with three experts and five students (in each cycle). Expert usability tests will only be conducted in the first cycle.

Design and Procedure. All participants had to sign a consent form prior to the study. We conducted a remote moderated usability test using Microsoft Teams. The usability tests were video-recorded and lasted a maximum of an hour. Prior to the usability study, experts were sent a short slide show briefly describing Pathway and its features. During the study, they were asked to use the prototype to explore Pathway's three main features: obtaining urgent help, obtaining a mental well-being score, and finding a mental health support service. They were asked to think aloud as they completed these tasks. At the end of the study, they were asked to give their opinions on the feasibility of Pathway as an application to help students search for mental health support, and what features might encourage students to use Pathway.
Students were asked to complete scenarios focused around Pathway's three main features and to verbalise their thoughts as they completed the tasks. Finally, students were asked semi-structured interview questions after completing each task and at the end of the scenarios. These questions centred around the privacy of data within Pathway, current methods of searching for support, the perceived usefulness of Pathway, and what features might encourage students to use the application.

Analysis. The video recordings from the usability tests were transcribed. These transcripts were analysed using the Table of Changes method in the person-centred approach [4]. A Table of Changes can be created after end-users interact with an intervention. A Table of Changes can be developed in the following steps: 1) identifying negative and positive comments about the elements/features of an intervention 2) discussing possible changes with team members i.e. how the problems identified can be solved 3) recording reasons for making changes e.g. easy to change, important for the success of an intervention, problem was mentioned repeatedly, change is supported by research/experts, etc. 4) identify agreed change and 5) determine if a change is a "must do", "should do", "could do" or "would like to do". As the current study is ongoing, our Table of Changes only includes negative, positive and neutral comments about the elements/features of Pathway.

3.4.2 Preliminary usability test results. The Pathway application was well received by participants in the usability test. Participants felt it was well-designed, time-saving and tailored to students. The following quotes exemplify these cases. S and E indicate students and experts respectively.

> *It's well done. The tone of it is good. It's clearly aimed clearly at students. But not in the way of talking down to them or anything. So yeah, I think it's good .. [E2]*

> *Well, it would save a lot of time because. If I was searching online, I would have to go through each then find the e-mail, then contact them and it would be back and forth like that could take a week or two before you find anything decent. But I think at least this one (Pathway), it's a few minutes, so it does save time. And as well, it's more specifically for here (Ireland) and for students. Whereas I searched that in Google, it could come up with American-only services or UK ones or ones not for students. So I think it's better in that way. [S1]*

Participants mentioned that including the sources of the information within Pathway was helpful.

> *It's good you have the information verified that helps [S1]*

Participants felt the preferences included in Pathway were helpful.

> *Ohh kind of service. Would you like to attend? Uh, I think it's pretty good having the three options cause uh, and for people who are maybe worried about the cost, don't have the money... You might not have your phone topped up or something, so having the e-mail option and then as well vice versa, like we [sic] maybe Wi-Fi. So might have to use the calls or messages. And the face-to-face options cause as well [S1]*

Participants suggested allowing students to choose what kind of support they need from a service.

> *But maybe you could have one on the actual issue like self-harm or body image or..? And even maybe for travellers or gay people. [S1]*

Participants felt that allowing anonymous logins was a good feature of Pathway. They highlighted that data privacy within the application should be explained in more detail.

> *I look up kind of period tracking apps and within that space, there's kind of concern as to ohh where is my data going? or how is it gonna be used? Um so maybe. I think it's really nice that you have at the beginning "you know you don't ask to log in because we don't…" It's an anonymous survey. So maybe somewhere a page that has a bit more information on your privacy or your data, and where it goes and maybe about the project... [E1]*

Recommendations of support services. As shown in Figure 1b, users are provided with a list of recommended mental health support services. Participants felt that the contact information for a support service should be more visible.

> *I'm trying to find the contact. I know you have the website. And maybe having the contact up might be handy. [S1]*

Participants found it difficult to discern how to access more information on support services.

> *So would you like a link here (referring to the list of recommended services - Figure 1b) or what are you thinking of? [E2]*

Curated information on support services. Participants found the curated information on support services helpful (Figure 2a):

> *(service description – MyMind) Yeah. And I think the fact that the users know, OK, this is from the service and they get a sense of kind of their ethos and the language that they use, which I think is really nice. So you kind of know straight away okay is MyMind for me? Are they saying things that I would like to hear? And then you're kind of coming back in with how Pathway (referring to curated information on MyMind) can help with the service, so kind of streamlining the information on what they might like. Yeah, I think that's really nice. So get a sense of how much people will pay and that's obviously very important to students. [E1]*
>
> *(on MyMind FAQs page) And I think they are very useful questions that you've chosen [S1]*

Participants noted that the source of student reviews and frequently asked questions should be clearly stated.

> *(student reviews) .. it could be said "taken from the website" if that's where they are from or if that's a feature of the app as well. [E1]*

Mental well-being score. Participants suggested that there should be an explanation of the importance of the mental well-being survey.

> *Okay so the next thing is to get my mental wellbeing score. I think it's just the thing about like, why are they doing this? [E2]*

Participants felt including a well-being survey was helpful for students so that they could have the language to discuss their issues when they do attend therapy/counselling. In addition, they noted the WHO-5 well-being survey was a good choice for a mental health survey.

> *[..] people are better informed and better educated about mental health than they used to be, and especially younger people. But it's definitely, yeah, it's definitely good to have something like this. Even gives them some sort of language to kind of, you know, if they do want to contact someone that they've at least done this and they gonna have some words to describe can how or why they are feeling that way. [E2]*
>
> *[..] it's quite positively worded and it's not like kind of leading people into focusing on kind of negative things or you know it's. it looks appropriate for something like this, you know and the fact that it's only 5 questions is really good as well. [E2]*

Participants felt that the results of the wellbeing survey should be explained in more detail.

> *I think maybe a comparison. So it just says your score is 25. Maybe having that on some sort of a graph or something like that to show where you are on the..? You know or like. A table or something like that maybe? It says your well-being is Excellent. So maybe it could show where excellent is where like good is where bad is. And that might help as well. Maybe some people have difficulty reading or have dyslexia having the chart there as well. [S1]*
>
> *And the well-being score. How is that calculated? Like, is that a proper science or? [S1]*

Clarity of information. During the usability test, participants were asked to tell us what they believe Pathway does based on the description provided. In doing so, we realised that the description of Pathway was unclear. In addition, before selecting their preferences for mental health support services, users are provided with a short description of what to expect from this section of Pathway. Participants felt this description could be further improved.

> *Okay and is this service (Pathway) um, does it allow students to say book a service or get in contact with? (No)..I think that's kind of mentioned there, but somewhere maybe to say. This is a recommendation service. We can't put you in direct contact with these. Just in case they think it's, you know if they've been trying before to get in contact with someone, think ohh. I'll. I'll book them through the app. [E1]*

S1 felt they would be able to select a therapy approach based on the explanations and links that Pathway provided. Conversely, experts felt that the information on therapy approaches should be more visible and that more explanation could be provided.

> *[..] I know it's important to have the link to kind of more information, but maybe you could compare and contrast them so like what would the difference between person-centred therapy be to CBT in like in a sentence just so they know if they don't read anymore what they might pick? ..Because I don't know how likely. I mean, some people will read all the information on, say, the NHS, but a lot of people won't as well. [E1]*

User Interface. The user interface of Pathway was well received by participants, they made very few errors while using the application. Participants noted the simplicity of Pathway, the conciseness of the text on the page, the presentation of the language and the continuity of the colours throughout the application.

> *I think it's really nice that it comes across very clearly...I thought it was really nicely laid out. And I think the user experience is very friendly and engaging for your users as well [E1]*

Finally, they suggested that the logo on the home screen should appear throughout the application.

4 DISCUSSION AND CONCLUSIONS

The aim of this project was to address the mental health treatment gap in the student population. Past research has explored barriers to help seeking in this population [17]. However, it has been hypothesised that this is only a partial explanation of why students do not seek support [12, 19]. Researchers have called for an examination of the demand and supply of mental health resources in institutions and communities [12, 19].

Our understanding of this was to examine if those who needed support were able to gain access to mental health support. Therefore, we conducted a survey exploring the barriers students encounter while accessing mental health support. The main barrier students faced was a lack of access to information they needed to support their decision-making process. For instance, how a service operates, what kind of support a service provides, the cost of the service, etc. As a result of this, students experienced delays in seeking help or did not access any help. Based on these needs, we developed a set of content requirements for Pathway.

In addition, our scoping review of online mental health interventions allowed us to understand students' needs regarding mental health technologies. This was further buttressed by open-ended responses in our survey in which students discussed their experiences using technology for mental health support. These studies had common points of interest and their combination produced a more robust set of usability and user experience requirements. These requirements guided the design of Pathway.

Despite this, we know that no application completely fits users' needs, and this is why we are conducting usability tests to further improve Pathway. The feedback received so far indicates that Pathway is a user-friendly, time-saving and useful application to help students find mental health support that fits their needs. We found that the usability requirements gathered from the scoping review and survey were well-grounded and helped build a version of Pathway that is tailored to students' needs. A majority of the feedback we received was concerning improving the presentation of the information in certain parts of the application. The current usability tests will be followed up with expert usability tests with other stakeholders i.e. mental health support services within and outside the university. We will examine their needs and explore how Pathway can fit into their current practices.

We believe that upon completing the usability study, Pathway will become a well-rounded, usable and acceptable application for this population.

5 SUPPLEMENTARY MATERIALS

The supplementary file shows screens from the Pathway application.

DECLARATION OF COMPETING INTERESTS

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

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