[Inner endpaper]

HEC MONTRÉAL
École affiliée à l'Université de Montréal

User Experience and Engagement Factors of Universal School-Based Digital Mental Health Programs:

A Qualitative Exploration of High School Students' Experiences and Perceptions

par
Erfan Badawi

Constantinos Coursaris et Sylvain Sénécal
HEC Montréal
Co-Directeurs de recherche

Thèse présentée en vue de l'obtention du grade de maîtrise ès sciences en gestion
(M. Sc.)
(Spécialisation User Experience in a Business Context)

Summer 2022

HEC MONTRÉAL

Comité d'éthique de la recherche

CERTIFICAT D'APPROBATION ÉTHIQUE

La présente atteste que le projet de recherche décrit ci-dessous a fait l'objet d'une évaluation en matière d'éthique de la recherche avec des êtres humains et qu'il satisfait aux exigences de notre politique en cette matière.

Projet # : 2021-4434

Titre du projet de recherche : Mindfulness Program for Youth: Design and Evaluation of a New Program Using a Design Thinking Approach

Chercheur principal :
Sylvain Sénécal,
Professeur titulaire, Marketing, HEC Montréal

Cochercheurs :
Erfan Badawi; Pierre-Majorique Léger; Constantinos-K Coursaris; Sylvie Lachize; Geneviève D'Arcy; David Brieugne; Roxanne Lajoie; Arielle Hakim; Danya Swoboda; Lola-Marie Grumbach; Rayan Abad; Audrey Mariamo

Date d'approbation du projet : 30 avril 2021

Date d'entrée en vigueur du certificat : 30 avril 2021

Date d'échéance du certificat : 01 avril 2022

Maurice Lemelin
Président
CER de HEC Montréal

HEC MONTRÉAL

Comité d'éthique de la recherche

RENOUVELLEMENT DE L'APPROBATION ÉTHIQUE

La présente atteste que le projet de recherche décrit ci-dessous a fait l'objet d'une évaluation en matière d'éthique de la recherche avec des êtres humains et qu'il satisfait aux exigences de notre politique en cette matière.

Projet # : 2021-4434

Titre du projet de recherche : Mindfulness Program for Youth: Design and Evaluation of a New Program Using a Design Thinking Approach

Chercheur principal :
Sylvain Sénécal
Professeur titulaire, Marketing, HEC Montréal

Cochercheurs :
Erfan Badawi; Pierre-Majorique Léger; Constantinos K. Coursaris; Sylvie Lachize; Geneviève D'Arcy; David Brieugne; Roxanne Lajoie; Arielle Hakim; Danya Swoboda; Lola Marie Grumbach; Rayan Abad; Audrey Mariamo

Date d'approbation du projet : 30 avril 2021

Date d'entrée en vigueur du certificat : 01 avril 2022

Date d'échéance du certificat : 01 avril 2023

Maurice Lemelin
Président
CER de HEC Montréal

Résumé

Cette thèse vise à identifier les facteurs qui pourraient ultimement augmenter les bénéfices et le succès des interventions numériques universelles en santé mentale en répondant aux attentes et aux désirs de leurs utilisateurs adolescents concernant l'expérience utilisateur des solutions numériques et donc en facilitant leur engagement pour les utilisateurs. À cette fin, l'équipe de recherche a choisi un type de recherche exploratoire, car il présentait une riche opportunité de mieux comprendre les expériences subjectives, les opinions, et les besoins des utilisateurs finaux réels, une perspective qui était absente dans la littérature liée à l'expérience utilisateur des programmes d'intervention numérique en santé mentale.

En réalisant un total de 16 entretiens qualitatifs semi-directifs avec quatre groupes de participants, plus précisément des entretiens individuels avec 8 élèves du secondaire qui ont eu des expériences avec des ressources numériques (n=6) ou non numériques (n=6) en matière de santé mentale (certains adolescents participants ont eu des expériences avec les deux ressources) et avec 8 élèves du secondaire qui ont été des utilisateurs fréquents (n=4) ou non fréquents (n=4) d'une solution spécifique de santé mentale numérique à l'échelle de l'école, les facteurs qui pourraient conduire les utilisateurs à mieux s'engager avec les programmes de santé mentale numériques, ainsi que les défauts et les inconvénients qui pourraient les en empêcher ont été investigués. Ensuite, en analysant thématiquement et en catégorisant nos résultats, les facteurs les plus importants qui pourraient faciliter l'engagement des utilisateurs dans les programmes d'intervention numériques en santé mentale ont été identifiés. Nous croyons qu'en utilisant nos résultats et nos recommandations proposées pour adresser chaque facteur d'engagement identifié, les développeurs et les designers de solutions numériques en santé mentale peuvent augmenter la probabilité que leurs programmes universels d'intervention en santé mentale en milieu scolaire puissent être effectifs pour la santé mentale des élèves du secondaire.

Mots clés : Interventions, École, Adolescent, Santé mentale, Santé mentale numérique, Santé mentale électronique, Engagement, Expérience utilisateur, Interaction homme-machine, Besoins des utilisateurs.

Abstract

This thesis aims to identify factors that could ultimately increase the effectiveness of universal school-based digital mental health intervention programs through addressing adolescent users' expectations and desires from using digital mental health solutions and thus facilitating engagement with them. To that end, the research team chose an exploratory type of research as it presented a rich opportunity to gain ample understanding about the subjective experiences, opinions and needs of the actual end-users, a perspective that had not been addressed in the literature related to the user experience of school-based digital mental health intervention programs.

Through conducting a total of 16 qualitative semi-structured interviews with four participant groups, specifically individual interviews with 8 adolescents that had experiences with either digital (n=6) or non-digital (n=6) mental health resources—while some participating adolescents had experiences with both—and with 8 adolescents who were frequent (n=4) or infrequent users (n=4) of a specific school-based digital mental health solution, the reasons that have led and could lead adolescent users to better engage with digital mental health intervention programs, as well as the shortcomings and disadvantages that prevented and could prevent that from happening were investigated. Then, through thematically analyzing and categorizing our findings, the most important factors that could facilitate user engagement with digital mental health intervention programs were identified. We believe that by using our gathered insights and our proposed recommendations in addressing each identified engagement factor, developers and designers of digital mental health solutions can increase the likelihood that their universal school-based mental health intervention programs could be effective for the mental health of high school students.

Keywords: School-Based Mental Health Interventions, Mental Health, Digital Mental Health, E-Mental Health, User Engagement, User Experience, Human-Computer Interaction, User Needs

Table of contents

Résumé v
Abstract vii
Table of contents ix
List of Tables xi
List of Figures xiii
List of Abbreviations xv
Acknowledgements xix
Preface xxi
Chapter 1. Introduction 1
Chapter 2. Article #1: User Experience of Universal School-Based e-Mental Health Solutions 11
Abstract 11
2.1 Introduction and Background 13
2.1.1 Current State of Adolescent Students' Mental Health 13
2.1.2 The Schools' Role in Addressing Adolescents' Mental Health Needs 13
2.1.3 Research Objectives 14
2.2 Key Concepts 15
2.2.1 User Experience 15
2.2.2 User Expectations 15
2.2.3 User Desires 16
2.2.4 Core User Needs 16
2.3 Methodology 16
2.3.1 Research Questions 16
2.3.2 Data Collection 17
2.3.3 Qualitative Analysis of the Interviews 19
2.4 Results and Discussion of Practical Implications 23
2.4.1 Core User Needs from e-Mental Health Solutions 23
2.4.2 User Expectations from School-Based e-Mental Health Solutions 24
2.4.3 Desired User Experience from School-Based e-Mental Health Solutions 26
2.5 Conclusion and Future Work 28
References 31
Chapter 3. Article: Facilitating Engagement [...] of Universal School-Based Digital Mental Health Solutions 33
Abstract 33
3.1 Introduction 34
3.2 Methods 36
3.2.1 Context 36
3.2.2 Recruitment and Participants 38
3.2.3 Procedure 39
3.2.4 Data Analysis 40
3.3 Results 43
3.3.1 Key Themes Emerged for the Main Participant Groups 43
3.3.2 Emergent Themes from Combining Data from All Participant Groups 46
3.4 Discussion 48
3.4.1 Overview of Key Findings 48
3.4.2 Theoretical Contributions 49
3.4.3 Implications for Practice 51
3.4.4 Limitations and Research Avenues 54
3.4.5 Conclusion 55
Supplementary Material 57
References 59
Chapter 4: Discussion 63
Appendix 1: Procedures and Guides for the Interviews 77
Appendix 2: Bibliography 83

List of Tables

Chapter 1: Introduction

Table 1: Personal contributions and responsibilities 6

Chapter 2: Article #1

Table 1: Core user needs driving the user expectations and desires from e-mental health solutions 23

Table 2: Descriptions of user expectations from school-based e-mental health solutions 25

Table 3: Descriptions of additional user desires from school-based e-mental health solutions 27

Chapter 3: Article #2

Table 1: Implications of the identified primary engagement factors and our recommendations 52

Table 2: Implications of the identified secondary engagement factors and our recommendations 53

Supplementary Table A: Characteristics of the interview participants 57

Chapter 4: Conclusion

Table 1: Summary of research questions and findings 65

Table 2: Discussion of practical implications of primary engagement factors 68

Table 3: Discussion of practical implications of secondary engagement factors..... 69

List of Figures

Chapter 2: Article #1

Figure 1: User expectations from using school-based e-mental health solutions 24

Figure 2: Additional desires of users from using school-based e-mental health solutions 26

Chapter 3: Article #2

Figure 1: Primary and secondary factors influencing user engagement with DMHIs. 47

Figure 2: Integrative diagram to inform the user experience of universal school-based DMHIs 48

List of Abbreviations

COVID-19:	Coronavirus Disease 2019
DMHI:	Digital Mental Health Intervention
HCI:	Human-Computer Interaction
HCII:	International Conference on Human-Computer Interaction
PF/SF:	Primary Factor / Secondary Factor
REB:	Research Ethics Board of HEC Montréal, also known as CER
TPC:	Technology-to-Performance Chain model
UE/AD:	User Expectations / Additional Desires
UX:	User Experience

Dedicated to my lovely parents and siblings
without whom nothing would have been possible for me…

Also dedicated to both my late grandmas,
and to Shahnaz Moghadam (Mami),
whose love and memories always reside within me.

Acknowledgements

I would like to begin the acknowledgements by thanking my supervisors and professors Sylvain Sénécal, Constantinos Coursaris, and Pierre-Majorique Léger who supported and guided me since the beginning of my master's program and throughout the thesis project; thank you so much for trusting me with this project and giving me this magnificent opportunity to collaborate with you. In the same manner, I would like to express my gratitude to and for the opportunity to learn from professors Annemarie Lesage and Camille Grange.

It was only through working with a team consisting of exceptional members that collection of such high-quality data for this project became possible: Sylvie Lachize, who thoroughly instructed me and other team members on the design thinking methodology for our data collection and analyses sessions; Geneviève D'Arcy and Roxanne Lajoie from Dis-Moi (now Relief), Tech3Lab's partner organization, who significantly helped in setting the project's general directions and recruiting the participants, also by acting as a backup support throughout our data collection; also the volunteer graduate students Danya Swoboda and Arriele Hakim, and undergraduate students Lola Grumbach and Rayan Abad, who all made outstanding contributions throughout the preliminary phases, also the main data collection and preliminary analysis stages.

And lastly, I am honored to extend my special thanks to my immediate family members, namely to my parents Azzam and Amatis and my beloved siblings Ebrahim and Nejla, for their precious presence, constant encouragements and emotional supports throughout my life and specifically during my graduate studies, also to my lovely aunts and uncles who inspired me throughout my academic journey, as well as my personal life. Moreover, I have been extremely lucky to receive the invaluable support, kindness and affirmation—for which I am and have been beyond grateful—from my dear friends, especially from (in order of our physical distance from each other): Parham Aledavood and Chakavak Nojavan, Mariana Córdova Pérez, Lan-Chi Maria Tran, Mehrzad Akhavein and Parmis Meshgi, Arian Vezvaee, Amir Mehdizadeh, Kiarash and Mehdi Rahmani, Auður Gabríela, Arash 'the Lord' Shahrokhi, Anita Keivan, Sina and Parsa Fathololoumi, Hossein Khorassani, Dr. Mohammad Sadegh Fatehi, Shaghayegh Yegane Afrouz, my lovely SBU classmates (Bahareh, Elham, Hamed, Hanieh, Negin, Ramin and Sajedeh), Ahmadreza Shabanzadeh, Niloofar Mashhadi, and last but not least, Niloufar Khavari.

Preface

This thesis is presented within four chapters and consists of two articles that were written as part of the Master of Science in User Experience in a Business Context and is submitted with the permission of the administrative director of M.Sc. program. All co-authors of the articles have given their permission for the articles to be used in this thesis.

The first article (Chapter 2) which is followed after an introduction chapter is titled "*User Experience of Universal School-Based e-Mental Health Solutions: Exploring the Expectations and Desires of Adolescent Users"* and was co-authored with Constantinos K. Coursaris, Sylvain Sénécal, and Pierre-Majorique Léger. For this article, a subset of all interviews, which we have labeled "supporting set" in the main article was used to report on the insights gathered specific to this subset. The article was prepared for and submitted to the International Conference on Human-Computer Interaction (HCII) based on Springer Nature's guidelines and formatting requirements. It was published as part of the HCII 2022 conference proceedings in volume 13328 of the Lecture Notes in Computer Science series (ISBN #: 978-3-031-05656-7) and presented during the conference on June 26th, 2022.

The second article (Chapter 3) titled *"Facilitating Engagement Through the User Experience of Universal School-Based Digital Mental Health Solutions: A Qualitative Exploratory Study"*, which is the main article of this thesis and reports on both the "main set" and the supporting set was co-authored with Constantinos K. Coursaris, Sylvain Sénécal, and Pierre-Majorique Léger. This article was written in compliance with Frontiers in Digital Health's submission guidelines with Vancouver reference style and its manuscript is planned to be submitted in early September 2022 as part of the journal's research topic "Factors Influencing User Engagement with Digital Mental Health Interventions".

This thesis ends with a discussion chapter, which similar to the introduction chapter follows APA Style's reference and formatting guidelines.

The HEC Montréal Research Ethics Board (REB) approved the data collection for this research project (project #: 2021-4434) in April 2021, and the certificate of approbation for this project was further renewed until April 2023.

Chapter 1. Introduction

1.1 Research Context

Recent reports and surveys on North America's mental health strongly suggest that adolescent students are in critical mental health conditions and require immediate attention. In its official report surrounding the impacts of coronavirus disease (COVID-19) pandemic on mental health, Statistics Canada (2020a) has emphasized that the youth had experienced more decline in mental health than any other age-groups in Canada. In another report dedicated to youth and children, Statistics Canada (2020b) indicated that more than half (57%) of the adolescents aged 15–17 had selected their mental health to be in *worse* or *much worse* condition since the rise of strict physical distancing measures across Canada. This significant decline in mental health states bears even more urgency when weighing it against the differences in opinions between adolescents of high school age (aged 12–17) and their parents (in this case, a parent or guardian who is considered most knowledgeable about adolescent) about the state of the adolescent's mental health: As Statistics Canada (2020b) reports, almost two-thirds of all parents (65%) had rated their child's mental health more positively than the individual adolescents themselves. In addition, Statistics Canada's report (2020b) outlines that the adverse mental health conditions have not only affected the overall health of adolescents, but also have caused adverse social outcomes, such as lower school grades and difficulty in making friends. Furthermore, in 2020, American Psychological Association declared a national mental health crisis and in its annual Stress in America (APA, 2020) report claimed that the COVID-19 pandemic has such profoundly affected the Americans that there would be severe mental health and social consequences in the following years.

Although recent studies and reports strongly emphasize that the state of mental health for adolescent students is critical, "mental health" is still a topic that cannot be openly discussed or attended. As evidence suggests, there are generally negative perceptions associated with adolescents seeking professional help for mental health concerns and problems. In their recent structured review of 53 studies regarding the perceived barriers of children and adolescents in seeking and accessing professional

mental health support, out of which 26 studies were conducted in North America, Radez et al. (2021) concluded that the three main barriers withholding young people from seeking help for mental health problems were (a) mental health stigma and embarrassment associated with seeking help, (b) a lack of mental health knowledge, and (c) negative perceptions of help-seeking as a sign of weakness in character. Similarly, the published report of a multi-phase research which was carried out to better understand the Americans' mental health care access points indicated that almost half (49%) of the Gen Z participants—teenagers and youth aged under 21 (at the time of research) who had previously sought mental health treatment—felt paralyzed by stigma as they worried about the judgment of others if they would have used mental health services, but also around the third of Gen Z participants (31%) who had tried to use mental health services had found it too difficult to discover where to go to receive the required help (Cohen Veterans Network, 2018).

Since adolescents' mental health requires urgent attention but there is not only a lack of access to both mental health education and resources, but also there is a paralyzing stigma associated with adolescents seeking professional help for their mental health, it would be up to the school system to lead the way in acting as both the educator and the resource center for adolescents' mental health needs. Schools are the place that the adolescents spend most of their time and have been identified as the focal points where the mental health needs of adolescents could be proactively identified and addressed (Masia-Warner et al., 2006). Through universally delivered digital mental health intervention programs, which are carefully designed resources delivered or enhanced via information and communications technology (such as online platforms, digital devices and computer applications) in order to improve mental well-being and to prevent from mental health complications for all the students (regardless that they would be at-risk for developing mental health complications or not), schools can provide their students with a cost-free, readily-accessible, and flexible solution for mental health education, training, and support (Tedder et al., 2015). In addition, digital mental health (or e-mental health) solutions offered in schools could be subjected to much less stigma, could provide more privacy and security for the adolescent students and more flexibility and consistency for the program designers and creators (Merry & Moor, 2015).

These benefits that would follow universal digital mental health programs could potentially lead to more student engagement than the non-digital mental health programs and the non-universal method of delivering mental health programs in schools (Merry & Moor, 2015), and as recent studies have signified, it is vital to focus on improving the users' engagement with digital interventions. Recent reviews of studies pertaining to user engagement with digital interventions have indicated that in order for digital mental health solutions to be effective for nonclinical users (i.e., not pursuing for mental illness treatment) in improving their overall psychological well-being and preventing from their mental health complications, user engagement is crucial (Gan et al., 2021; Saleem et al., 2021). Most of the studies included in these reviews, however, have been primarily concerning adults (aged 18 and above), and have been focused outside the school system and were not concerning mental health interventions in high schools.

1.2 Research Goals and Questions

As focusing on the mental health of adolescents deemed critical at this moment, especially due to the mentioned recent concerns raised about these vulnerable members of society since the start of COVID-19 pandemic, and as reported, the main question that high schools were facing was how they could maximize the likelihood that their students could receive the intended benefits from digital mental health interventions, we aimed to design a study that could not only fill the existing gap within the academic literature surrounding the perspectives, opinions and needs of adolescent users pertaining to school-based digital mental health interventions, but also could help inform the design and development of such interventions to address the concerns of high schools. As a research team consisting of professionals in the academia (three professors at HEC Montréal who were highly experienced in the information technology, user experience, and marketing fields) as well as in the industry (the founder of a non-profit organization that offers digital mental health solutions across Québec, Canada), also an experienced mental health professional (the well-being Director at the same non-profit organization) and selected dedicated researchers (apart from the writer of this thesis, four volunteer students from HEC Montréal who were studying at the master's and bachelor's level in relevant fields), we believed to be well-equipped for partaking in this research project and achieve said goals.

To achieve our research goals, our team set out to explore the perspectives of high school students in order to understand their perceived experiences and opinions regarding digital mental health solutions and their needs pertaining to the user experience of universal school-based mental health intervention programs. To this end, two sets of interviews with individual participants were conducted: (a) the research team sought to gain a better understanding of and insights into the adolescents' subjective experiences and opinions surrounding both digital and non-digital mental health resources through conducting individual interviews with high school students who had experiences with these resources. For this set of interviews and for the purpose of promoting this sensitive and important topic to the international community of academics and professionals in the human-computer interaction field, a dedicated article (Chapter 2) was developed focusing on research questions specific to these users, and a summary of the article was presented by us at the HCI International 2022 conference; and (b) in light of findings about the significance of user engagement with digital mental health intervention (DMHI) programs, the research team explored the factors related to the user experience of digital mental health solutions that could contribute to a high or low level of engagement with universal school-based DMHI programs through interviewing the frequent and the infrequent users of such programs. By focusing on the two latter user groups as the "main set", and the users introduced earlier (used for developing Chapter 2) as the "supporting set", the main article (Chapter 3) for this project was developed.

The following are the specific research questions that this thesis will seek to answer leading up to the principal research question (i.e., Q4) that has guided this research effort:

Q1: What are the main underlying factors that drive adolescent students' expectations and desires from universal school-based digital mental health solutions? **(Chapter 2)**

Q2: What are the factors related to user experience of digital mental health solutions that drive the engagement of frequent adolescent users with DMHI programs? **(Chapter 3)**

Q3: The absence of which factors related to user experience of digital mental health solutions lead to a lack of engagement with DMHI programs for infrequent adolescent users? **(Chapter 3)**

Q4: What factors related to user experience of digital mental health solutions facilitate adolescent students' engagement with DMHI programs? **(Chapter 3)**

1.3 Potential Research Contributions

Due to the exploratory nature of our study, the research team aimed to extend the body of knowledge in the contexts of the user experience of school-based digital mental health interventions, also the needs specific to adolescents that are targeted for universal mental health interventions. In a broader sense, it is hoped that our methodological approach could be replicated and used in similar contexts for conducting qualitative studies concerning adolescents, and students in general.

Furthermore, as the research team aimed to contribute to the practice by informing the user experience of digital mental health solutions, specific recommendations were proposed that could help the designers and developers of digital mental health intervention programs put a more focused effort and create a better product and service strategy for addressing the user needs. We believe using our insights and recommendations can help increase the likelihood that digital mental health interventions could be effective and beneficial for high school students.

1.4 Personal Contributions to the Research

This research project was completed while working at HEC Montréal's Tech3Lab. The following table summarizes my responsibilities and contributions to the research project from its initiation up to writing the thesis. The percentage of work that I have completed per each step of the project is also presented within Table 1.

Table 1

Personal contributions and responsibilities

Step	Contribution
Initiation	Defining the project and deciding on the project's general directions **– 15%** • The scope and limitations of the research, its stakeholders and directions were decided together on a meeting that consisted of Tech3Lab directors (both my co-supervisors and Dr. Pierre-Majorique Léger), the two directors of Dis-Moi (Tech3Lab's partner organization), and Sylvie Lachize (an instructor of design thinking methodology and a partner of the lab).
Literature review	Conducting a preliminary review of recent grey literature **– 20%** • This review which helped in the preliminary identification of research goals and questions was done with the help of 4 volunteers from HEC Montréal who were attached to the project through the design thinking methodology workshops held by Ms. Lachize: graduate students Danya Swoboda and Arriele Hakim, and undergraduate students Lola Marie Grumbach and Rayan Abad. Conducting in-depth research among scientific articles related to topic **– 100%** Identifying the conceptual frameworks to be used in the study **– 33%** • The Four Fundamental Human Needs model was proposed by Ms. Lachize, and the Technology-To-Performance Chain model was proposed by my supervisors. I further adapted both to the specific context of our research. • I identified and proposed the "user engagement as a bidimensional construct" framework. My supervisors offered feedback and guidance that helped finetune and solidify the structure of the second article. Synthesizing the relevant literature and concepts for writing the articles **– 100%**
Identifying the research questions	Identifying the gaps in the literature to define the main research problem **– 100%** Defining the phase-specific research questions **– 50%** • The questions specific to the frequent and infrequent users were defined with the same group of people who initiated the project, as it was decided the participants' pool for this phase should come from the users of Dis-Moi's platform.
Ethics	Preparing documentation related to application submission to the REB **– 100%** Completing the submission to the REB and subsequent modifications **– 100%**
Research procedure	Developing the qualitative interview procedures **– 75%** • As our project was concerning the adolescents, feedback from my supervisors, Dis-Moi's mental health professional and REB helped ensuring all necessary accommodations are provided to maximize participants' comfort and trust, and all unnecessary elements that could have caused complexity or concerns are removed. Determining the semi-structured interview questions **– 50%** • The nature and sequence of semi-structured interview questions were adapted from Ms. Lachize's instructions on the methodology and the user needs research. Planning for the data analysis processes in advance **– 50%** • I ensured the processes and analyses sequences could respect the instructions of Ms. Lachize pertaining to data analysis steps in user needs research.

Step	Contribution
Recruitment	Identifying the inclusion and exclusion criteria – **50%** • I set the general criteria with the directions of my supervisors and Ms. Lachize, but the exact criteria for identifying students that were either frequent users or infrequent users of Dis-Moi's platform were identified by Dis-Moi's team. Creating online recruitment forms and emails (both English & French) – **100%** Solicitating, screening and recruiting the participants – **75%** • Some emails were sent by the high schools that were part of Dis-Moi's network to their students that we had identified. I managed all the subsequent communications and formal recruitment of students who contacted us via filling the online forms. Managing the interview schedules – **100%** Managing the participant compensations – **100%**
Data collection	Interviewing the participants – **25%** • I conducted four interviews (all in English), while the other interviews were conducted by the volunteer students: Danya (25%), Arielle (6.25%), Lola (12.5%), and Rayan (31.25%). Acting as the notetaker during the interviews – **12.5%** • I acted as the notetaker during two interviews (both in English), while the other notes were taken by the volunteer students: Danya (25%), Arielle (18.75%), Lola (37.5%), and Rayan (6.25%).
Data extraction and transformation	Extracting & cleaning data from audio recordings (all English sessions*) – **37.5%** Summarizing scripts & contextual notes (all English sessions*) – **37.5%** * For French sessions, these steps were performed by the sessions' notetaker.
Analysis	Thematic Analysis – **100%**
Writing the articles	Writing the articles and the thesis – **100%** • Not taking into account the support and input of my supervisors since the first draft

Note. Due to the exploratory nature of this research and having different participant groups, some steps were repeated or continued while other step(s) were taking place.

References

American Psychological Association (APA). (2020). Stress in America™ 2020: A National Mental Health Crisis. https://www.apa.org/news/press/releases/stress/2020/sia-mental-health-crisis.pdf

Cohen Veterans Network. (2018, October). *America's mental health 2018*, 11. National Council for Mental Wellbeing (formerly known as National Council for Behavioral Health). https://www.cohenveteransnetwork.org/wp-content/uploads/2018/10/Research-Summary-10-10-2018.pdf

Gan, D. Z. Q., McGillivray, L., Han, J., Christensen, H., & Torok, M. (2021). Effect of engagement with digital interventions on Mental Health Outcomes: A systematic review and meta-analysis. *Frontiers in Digital Health*, 3. https://doi.org/10.3389/fdgth.2021.764079

Masia-Warner, C., Nangle, D. W., & Hansen, D. J. (2006, November). Bringing Evidence-Based Child Mental Health Services to the Schools: General Issues and Specific Populations. *Faculty Publications, Department of Psychology*, 71. https://digitalcommons.unl.edu/psychfacpub/71

Merry, S. N., & Moor, S. (2015). School-based mental health interventions. In A. Thapar, D. S. Pine, J. F. Leckman, S. Scott, M. J. Snowling & E. Taylor (Eds.), *Rutter's child and adolescent psychiatry* (6th ed., pp. 545–558). chapter, Wiley-Blackwell.

Radez, J., Reardon, T., Creswell, C., Lawrence, P. J., Evdoka-Burton, G., & Waite, P. (2021). Why do children and adolescents (not) seek and access professional help for their mental health problems? A systematic review of quantitative and qualitative studies. *European Child & Adolescent Psychiatry*, *30*(2), 183–211. https://doi.org/10.1007/s00787-019-01469-4

Saleem, M., Kühne, L., De Santis, K. K., Christianson, L., Brand, T., & Busse, H. (2021). Understanding engagement strategies in digital interventions for mental health promotion: Scoping review. *JMIR Mental Health*, *8*(12), e30000. https://doi.org/10.2196/preprints.30000

Statistics Canada. (2020a, October). Impacts on Mental Health. https://www150.statcan.gc.ca/n1/pub/11-631-x/2020004/s3-eng.htm

Statistics Canada. (2020b, July). Canadian Health Survey on Children and Youth. https://www150.statcan.gc.ca/n1/daily-quotidien/200723/dq200723a-eng.htm

Tedder, M., Shi, L., Si, M., Franco, R., & Chen, L. (2015). eMindfulness therapy — a study on efficacy of blood pressure and stress control using mindful meditation and eating apps among people with high blood pressure. *Medicines*, *2*(4), 298–309. https://doi.org/10.3390/medicines2040298

Chapter 2: Article:

User Experience of Universal School-Based e-Mental Health Solutions

Exploring the Expectations and Desires of Adolescent Users [1, 2]

Erfan Badawi, Constantinos K. Coursaris, Sylvain Sénécal and Pierre-Majorique Léger
HEC Montréal, Montréal, Canada

Abstract

Due to lack of in-person social interactions and stressful conditions resulting from schools' closures, major lockdowns, and other restrictions imposed for preventing the further spread of COVID-19, there has been a great concern regarding adolescents' mental well-being and their access to mental health resources. Now, e-mental health resources that schools can develop and offer to all their students could play a much more important role: as a valuable, accessible, and affordable means for educating and empowering adolescents to maintain a balanced mental and emotional well-being. In this paper, we aim to explore the expectations and desires of adolescent students from using universally delivered school-based e-mental health solutions. Through conducting qualitative exploratory interviews with adolescent students and performing contextual analysis, we have identified the core needs, expectations and desires that were shared between high school students pertaining to e-mental health resources. By reporting our findings via diagrams and tables, we offer HCI and UX designers and developers a means to help them create a better strategy for their universal e-mental health solutions and put a more focused effort into addressing the core needs, expectations, and desires of adolescent students from said solutions: first, by providing them the solutions' *must-haves* (the identified user expectations from e-mental health solutions), and then, by targeting to include the solutions' *nice-to-haves* (the identified factors that can make the experience of e-mental health solutions more desirable for the students).

Keywords: School-Based Mental Health Interventions, E-Mental Health, Computer-Based Learning, Human-Computer Interaction, User Experience, User Needs

---

[1] First published in [volume 13328 of the *Lecture Notes in Computer Science* series, p. 406–419, 2022] by Springer Nature. (ISBN: 978-3-031-05656-7, doi: 10.1007/978-3-031-05657-4_29). Unedited parts are reproduced with permission from Springer Nature.

[2] This article uses and reports on a subset of interviews conducted as part of the main research project, but answers to questions specific to this subset, which will be only presented in this article. This subset is labeled as the "supporting set" in the main article of the thesis, which will be presented in Chapter 3.

2.1 Introduction and Background

2.1.1 Current State of Adolescent Students' Mental Health

Recent grey literature surrounding North American adolescents' mental health reveal that psychological distress, anxiety and depression symptoms have been rapidly rising among the youth, especially since the start of the COVID-19. Compared to other age-groups, Canadian adolescents have experienced the greatest decline in their mental well-being due to the restrictions imposed for preventing the further spread of COVID-19 [1]. The results of Statistics Canada's 2021 crowdsourced data on the topic of children and youth's health show 57% of adolescents aged 15–17 had self-reported to be in *worse* or *much worse* mental health condition compared to their condition before COVID-19 era's drastic measures, i.e., several months with complete lockdown, schools' closures, and strict physical distancing measures across Canada [2]. Similarly, in the US, it has been found that adolescents' stress, anxiety, and depression symptoms have been rising. In October 2020, American Psychological Association (APA) declared a national mental health crisis after publishing the results of its study which was conducted through surveying the US residents of different age groups during the pandemic: In APA's report, 43% out of a total of 1,026 adolescent students aged 13–17 who responded to the survey stated their life stresses had increased since the start of the pandemic [3].

2.1.2 The Schools' Role in Addressing Adolescents' Mental Health Needs

Due to adolescents' alarming mental health conditions and lack of access to mental health resources and education, the high school setting could—and arguably should—become the optimal resource center for educating the students and for providing them the appropriate tools and resources for their mental health, and specifically, by doing so through accessible and non-discriminatory universal mental health programs. Compared to *targeted* programs which focus on risk status of the students for mental illness prevention or treatment, the *universal* programs either deliver general mental health education and resources throughout the school or provide grade-specific programs—tailored to the specific needs of the students' age and grade—as part of the formal curriculum or as an after-school activity [4].

When designing a universal mental health intervention program, schools can choose to use information and communications technology to their benefit by developing an e-mental health[3] solution either as an extension to their program or as the primary method of the program's delivery. Through e-mental health solutions, which could be comprised of web-based, mobile or other kinds of digital and online applications and interfaces, schools can deliver inexpensive, flexible, timely, and readily available access to mental health resources for their students which would have been otherwise not possible for them [6].

2.1.3 Research Objectives

As we saw a great need—especially due to concerns raised since the start of COVID-19 pandemic—for better understanding adolescent students' subjective experiences with universal school-based e-mental health resources, and since we found it to be a gap in the qualitative academic literature, we attempted to identify the factors that could positively impact the overall user experience of these resources for their adolescent end-users. More specifically, we sought to learn the subjective opinions, experiences, and preferences of adolescent users regarding both e-mental health and traditional mental health programs in order to better understand what kind of experience they expect to have with school-based e-mental health programs and how these programs can become more desirable for them.

In this paper, we aim to uncover some of the main expectations and desires of adolescent users from universal e-mental health solutions' user experience, also to specify how schools can target the users' expectations and desires when developing or redesigning an e-mental health solution or when developing or redesigning the activities and features to be offered inside it. Our goal is to present the human-computer interaction (HCI) and user experience (UX) designers and developers a means to help their universal school-based e-mental health solutions meet the needs, expectations, and desires of its intended users, and as a result, increase the likelihood that these solutions could provide a more satisfactory experience for their users.

[3] As outlined by Mental Health Commission of Canada, *e-mental health* or *electronic mental health* is an umbrella term for mental health services and resources delivered or enhanced through the use of information and communications technologies, including internet and computerized resources and apps, peer support platforms through social media or other technologies [5].

Through our exploratory study, we hope to extend the body of knowledge in the context of the needs specific to adolescents' mental health, also contribute to the practice by informing the user experience of e-mental health solutions. At a broader level, our methodological approach may be used in other situational contexts thereby contributing to advancing the body of knowledge pertaining to HCI and UX studies concerning adolescents' well-being.

2.2 Key Concepts

In this section, definitions of key HCI/UX-related concepts that will be used in this paper will be presented, and when applicable, the extent to which that each definition would apply to the research context.

2.2.1 User Experience

Adapted from the definition provided by International Organization for Standardization (ISO), here, the *user experience* (UX) of a specific universal school-based e-mental health solution for an individual user is defined as the user's perceptions, opinions, beliefs, also emotional, behavioral, and other psychological and physiological responses resulting from interacting with and anticipating using the solution [7]. Since this exploratory study's scope does not include any stakeholders other than the intended end-users of universal school-based e-mental health solutions, i.e., adolescent students, we will only focus and comment on the experiences that these solutions provide for them.

2.2.2 User Expectations

In accordance with our definition of user experience, *user expectations* for an adolescent student are defined as an individual's anticipations or predictions—based on past experiences, knowledge, and intuitive feelings—from the experience of using or possible future use of a specific solution. Therefore, in this paper, the interchangeable terms "expectations from [using] a solution" and "user expectations", which could also be translated as what users consider to be a "solution's must-have", would encompass any anticipated or predicted emotional, behavioral, physical, mental, belief-related, and achievement-related outcome for the end-user.

2.2.3 User Desires

In accordance with our definitions of user experience and user expectations related to universal school-based e-mental health solutions, *user desires* from using a solution to encompass not only user expectations (i.e., the solution's must-haves*)*, but also additional factors that would make the experience more desirable for the user (i.e., the "solution's nice-to-haves").

2.2.4 Core User Needs

To uncover and identify user expectations and desires from using e-mental health resources, especially those that were not explicitly expressed by the participants, we deemed it necessary to use a classification model that could explain what underlying factors were driving the users' expectations and desires. For this purpose, the Four Fundamental Human Needs model was adapted to classify our findings. In this model, "Comfort", "Connection", "Uniqueness", and "Variety" are described as the four fundamental needs of digital users [8]. This model, which proved to have close similarities with our study's direction and objective can help explain the behaviors of digital consumers and support digital disruptors in creating better product strategies [8].

The way we have adapted this model to classify our participants' core needs—the main factors driving and defining their expectations and desires from e-mental health resources—will be illustrated later, in the results section (see Table 1).

2.3 Methodology

2.3.1 Research Questions

To reach our research objectives and explore the areas that would require special attention from HCI and UX developers to increase the likelihood that the experience of their universal school-based e-mental health solutions could meet the expectations and desires of its adolescent users, a qualitative methodology was adopted. The specific research questions on which our exploratory qualitative study was focused were the following:

1. What are the main underlying needs that drive adolescent students' expectations and desires from universal school-based e-mental health solutions?
2. What do adolescent high school students expect from using universal school-based e-mental health solutions?
3. What factors could make universal school-based e-mental health solutions more desirable for adolescent students?

After agreeing on our study's scope and research questions, our study protocol and semi-structured interview questions were developed in order to better explore the experiences and opinions of adolescent students with mental health resources—both non-digital and e-mental health solutions—and their motivations and goals from using them. To this end, the interviews' preliminary and follow-up questions were determined in a way that could help us focus on (a) finding the answers to "when", "why", and "how" each adolescent's experiences with mental health resources started and continued; (b) uncovering each adolescent's positive and negative experiences with these resources and their consequent impacts; and (c) discovering each adolescent's subjective opinions about the resources' shortcomings and improvements that these resources would require in order to meet user expectations and desires, and to help individuals in achieving their mental health goals.

Following the submission of our complete study protocol to HEC Montréal's Research Ethics Board (REB) and receiving the certificate of approbation for our research from the board, the recruitment and data collection processes started in mid-May 2021.

2.3.2 Data Collection

In our data collection period, individual semi-structured interviews were conducted through a video conferencing platform with eight unique adolescent participants, each lasting 40 ± 10 minutes, depending on how the conversation unfolded. To participate in our interviews, the requirement for the students was to be fitted into at least one of the two following categories:

1. *High school students who have participated in and have a good recollection of their experiences with non-digital mental health-related activities that were not pursued for mental illness treatment or rehabilitation purposes (n=6).*

Adolescents of the first participant group had experiences in one or more preventive or promotive mental health-related activities such as meditation, yoga, and deep-breathing exercises. Out of these 6 participants, half of them were students at public schools while the other half were studying at private schools: (a) the public-school students were all from the same high school that offered an optional traditional (non-digital) mental health course. The course had a mental health instructor who was present during the class times and apart from educating the students about the psychophysiology of stress, anxiety, calmness and other relevant topics, the instructor would teach them different exercises and techniques for stress management and increasing awareness; the instructor would also engage in moderating and assisting in the group exercises (deep breathing, meditation, yoga, etc.) and facilitating the discussion periods in which the students exchanged their experiences, shared their struggles and success stories regarding their mental well-being challenges; and (b) other students who had not been offered a similar class by their private high schools were adolescents who were interested in pursuing yoga, meditation, or similar activities for the benefits that those would give them. These students had all started their journeys with mental health exercises either with a non-professional guide, such as one of their parents, or through attending a professional instructor's sessions with one of their close family members. All participants from this participant group were residents of Quebec province except one from Ontario province, and most interviews (4 out of 6) were conducted in French.

2. *High school students who have had experiences in using e-mental health resources and have a good recollection of these experiences (n=6).*

Adolescents of the second participant group had experiences using resources related to meditation, yoga, mindfulness, mental focus, sleep aid, anxiety- or stress-relief. Out of these six adolescents, half were students at public schools while the other half were studying at private schools. The majority of these students were residing in the Quebec province (4 out of 6) while the rest were from Ontario; three interviews for this participant group were conducted in English, and the other three, in French.

Overall, out of a total of 8 individuals, 4 adolescents (2 students from public high schools and 2 students from private high schools) met the criteria for both interview categories and responded to our interviews' semi-structured and follow-up questions pertaining to both groups.

2.3.3 Qualitative Analysis of the Interviews

Analysis Process for Individual Interviews. After the completion of each interview, our qualitative analysis started with developing its transcript through listening to the recorded interview. As we were also interested in uncovering each participant's underlying needs and those expectations and desires that were not explicitly expressed during the interviews, additional steps that were performed were through listening to the audio recording for each interview again to extract the contextual cues, information, and insights from each interview and to fill the gaps between what was expressed and what was concealed or remained undiscovered by each participant. The findings from the second listening were directly added into each interview transcript, which we had anonymized to protect the identity of each individual who was interviewed, as a side note. This method was used since due to privacy concerns and following REB's recommendations, it was decided that no video outputs, but only the audio outputs of our interviews with our adolescent participants should be captured—and only after receiving their written consent before the interviews, and the verbal confirmation at the beginning of our interviews with each participant—and therefore, it was important for us to listen more closely and to pay more attention to changes in tones, pauses, and other vocal expressions and cues that could provide additional insights and contexts to each student's answers. To maximize efficiency and accuracy, all the above steps were set to be completed within a maximum of 48 hours from the starting time of each interview; this way, our memories from each participant and the discussions that took place during each interview could still remain fresh, which would also present us a more accurate and quicker way to extract, organize, and further analyze our findings in the consequent steps.

Process for Analyzing the Interviews Within a Participant Group. After finishing data collection in each participant group and completing the analysis for all individual interviews of that group, each annotated transcript was analyzed individually so we could extract each participant's opinions, motivations, goals, positive and negative experiences pertaining to mental health interventions and resources. The output from this round of analysis was in the format of short phrases, each in the language that was chosen for the interview by its participant. Then, all the short-phrase findings of each participant group were grouped

together with the following method: **A)** for those phrases that had similarities with each other: **(1)** if they were from the same participant, only one of the phrases that was more representative was kept and the others were discarded; **(2)** if they were not from the same participant and if there was a phrase that represented all the other similar phrases, only that phrase was kept and the others were discarded after taking note of the number of similarities to the phrase that was kept; and **(3)** if they were not from the same participant and there was no phrase that represented all the other similar phrases, a more representative phrase was generated, and all the similar phrases were listed via bullet points under it. **B)** for phrases that had no similarities with each other, they were kept as is for this round of analysis.

Process for Combining the Findings of Both Participant Groups. After the data collection period and data analysis process for both participant groups were completed, the short-form and bullet-pointed list of phrases were color-coded according to the participant group to which they belong. Then, our findings were combined together with the following method: **A)** for those phrases that had similarities with each other: **(1)** if there was a phrase that represented all other similar phrases, that phrase was kept and the others were discarded, also, the color-code was changed to a new one to represent the phrase belongs to both participant groups; if there were numerical values—representing similar ideas that were previously discarded—associated with the discarded phrases, these number were noted; and **(2)** if there was no phrase that represented all other similar phrases, a more representative phrase was generated with the color-code that represented both participant groups, and all the similar phrases were listed via bullet points under it while the numerical value associated with any phrases before getting combined with others was noted. **B)** for phrases that had no similarities with each other, they were kept as is at this stage.

Process for Analyzing the Combined Findings. After combining our findings from both participant groups, all the resulting phrases were classified via following groups that were derived from our study's group-specific objectives and our preliminary data analysis:

- Essential benefits of e-mental health solutions and resources for the users
- Critical disadvantages or shortcomings of e-mental health solutions and resources
- Desired areas of improvement for e-mental health solutions and resources
- Factors motivating the users in pursuing the betterment of their mental health
- Shared goals of the users in pursuing or completing mental health-related activities

Then, as our aim was to use an inductive approach to generate themes among our findings, further investigations took place in order to find patterns among the phrases. To this end, since not all the phrases had the same structure (as they were mostly derived directly from the interview transcripts), it was first required they would all be transformed into phrases that would have a similar structure: Because our goal was to focus on the users and understand their core needs, expectations, and desires from school-based e-mental health solutions, the phrases that were about e-mental health resources' benefits, shortcomings and desired improvements—which were either derived directly from the results for the second participant group or discovered via comparison of results in both participant groups—were transformed into phrases that would consider the point-of-view of the users who would have felt that benefit, the lack, or the need. The following example presents an instance where the structure of a phrase related to shortcomings of e-mental health solutions was transformed into a phrase that represented an unmet need of the adolescent users.

Example. The phrase "*Not communicating the expected outcome or learning objective from specific activity*" was derived from both participant groups, hinting that both traditional mental health and e-mental health programs and resources have had a similar shortcoming for their adolescent participants. This finding suggests that developers of e-mental health solutions should plan for providing their students sets of clear expectations about the outcomes and learning objectives of the programs, and the effort required for reaching them. Therefore, the original phrase was transformed into "Being able to set clear expectations for a mental-health related activity", which conveyed what the users felt lacking in e-mental health solutions.

After ensuring all the structures of phrases were similar and from the users' point-of-view, the main themes that were shared between the users were identified: the main factors—core needs—that drove our participants' experiences with mental health solutions and resources. The themes that emerged from our attempt to reorganize our findings based on the core needs that were shared between our participants were consistent with the Four Fundamental Human Needs model: the *fundamental* needs for *connection*, *comfort*, *variety*, and *uniqueness* [8]. Therefore, to better classify our findings, the model was adapted to the specific context of our research, and the identified categories for the core needs were named after the mentioned fundamental needs (see Table 1).

After reorganizing our findings to generate the main themes (i.e., core user needs), we then sought to discover the most important phrases related to each core user need to identify the most important user expectations and desires. To this end, the phrases that either had the most occurrences or had the most weight were identified. To identify the most occurrent phrases, the following steps were performed:

1. First, it was identified in which participant group(s) the phrase was shared: If it was shared in both groups, therefore, it had more priority over the others with the same number of occurrences that were only part of one group.
2. Then, it was checked whether the phrase was generated to represent a combination of similar phrases: If in fact it was, the bullet-point form phrases that were listed below it during the analysis process—before two or more phrases were grouped together—signalled the total number of occurrences of the phrase; in other words, total number of occurrences would be one less than the total number of bullet-point form phrases.
3. Next, it was verified if the number of a phrase's past occurrences was noted next to it; a practice that was done each time similar phrases were combined during each round of analysis: If there was a numerical value next to a phrase, it would indicate how many more times the phrase had occurred.
4. Lastly, by calculating the number of additional occurrences identified in the steps above for each of the phrases, it was determined which phrases were more occurrent than the others and thus represented those expectations and desires that were shared between the users more than the other phrases.

Moreover, to identify phrases with the most weight, our interview notes were revisited to investigate which benefits, shortcomings, positive and negative experiences related to mental health interventions and resources were more urgent and sensitive to focus on. The urgency and sensitivity of such topics were recognized either by participants themselves, when during the interviews they had explicitly or implicitly put more emphasis on the matter, or the gravity of positive or negative effects of the discussed topic throughout the interviews were acknowledged by the research team. After establishing which topics should have more weight, the phrases that were related to them were identified. By only keeping the phrases that had the most occurrence or the most weight and by discarding other phrases, the most essential needs, motivations, and goals that either the adolescents expected or desired to address via their experiences with universal school-based e-mental health solutions were identified.

2.4 Results and Discussion of Practical Implications

In this section, the results of our study will be gradually presented via diagrams and tables. For the purpose of clarity, color-coded tables and figures are used to demonstrate how our findings from each stage would contribute to other stages.

2.4.1 Core User Needs from e-Mental Health Solutions

As the starting point in our classification, and to answer our first research question, we identified the *core user needs*, which we recognized as the underlying needs that drive the adolescent students' expectations and desires from e-mental health solutions. These needs were derived from the main themes among the needs, motivations, and goals that were shared between all the participants in our study, which as explained, were named after the categories of four fundamental human needs model: Comfort, Connection, Variety, and Uniqueness [8]. In Table 1, the definition for each of the core user needs and what they represent for e-mental health solutions' designers and developers are presented; later, it will be clarified how each HCI/UX-related concept could be used to inform the design of e-mental health solutions.

Table 1. Core user needs driving the user expectations and desires from e-mental health solutions; adapted from Forrester Research's four fundamental human needs model [8].

Core User Needs	**Comfort**	**Connection**	**Variety**	**Uniqueness**
Definition	The need to remove ambiguity, complexity, and sources of stress associated with the experience	The need to belong with others and to feel welcomed and supported in the course of the experience	The need to feel excited about possibilities and to anticipate new experiences and diversions from monotony in the course of the experience	The need to feel special, capable, and optimistic about opportunities for improvement in the course of the experience
Connection to HCI/UX	Knowledge Psychological Safety Usefulness Ease-of-Use	Ease-of-Use Usefulness	Personalization Customization Gamification Usefulness	Self-Efficacy Knowledge Personalization Usefulness

2.4.2 User Expectations from School-Based e-Mental Health Solutions

Next, to answer our second research question, we identified the needs, motivations, and goals that adolescent users expected to address more than others via their experiences with school-based e-mental health solutions. In Fig. 1, the most important user expectations from high schools' universal e-mental health programs are presented.

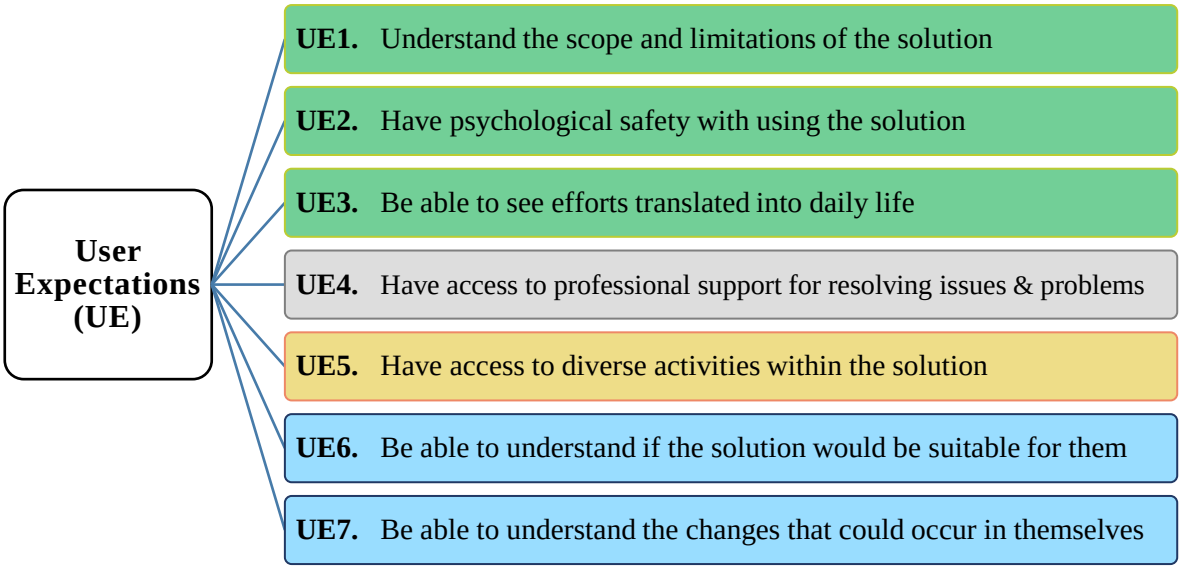


Fig. 1. User expectations from using school-based e-mental health solutions.
Note: Here, each user expectation's color scheme corresponds to that of core needs depicted in Table 1.

The description of each expectation (UE1–7), their connections to the core user needs (i.e., the main driving factors of user experience of e-mental health solutions for students), and their practical implications for the schools and practitioners in the HCI and UX fields are presented in more details in Table 2.

Table 2. Descriptions of user expectations from school-based e-mental health solutions.
Note: Here, the color scheme corresponds to the color schemes presented in Fig. 1 and Table 1.

Related Core Need	UE#	Description
Comfort	**1**	This expectation, which signifies a critical shortcoming of mental health resources is concerned with removing unneeded ambiguities and providing clear communications about the scope and limitations of an e-mental health solution to help the users make an informed decision.
	2	A critical shortcoming in and an essential motivating factor for using e-mental health solutions, this expectation is about the need to use a solution without additional concerns such as chances of failure or criticism, and it could be addressed by removing unneeded sources of such stresses and maximizing the psychological safety of the users.
	3	This expectation is concerned with a critical shortcoming in and an essential motivating factor for pursuing mental health-related activities: The users require to be able to anchor the activities and learnings from the mental health resources into their daily life, they might otherwise find the solution to have no benefits or any usefulness for them.
Connection	**4**	This expectation represents a valuable factor for the users who would need to be able to remove complexities as they arise during or throughout their experiences with an e-mental health solution through receiving professional support. For the designers, not only ensuring there would be no major usability issues or complexities leading to this need for the users, but also providing an easy access to support is a crucial consideration.
Variety	**5**	An essential motivating factor for the users and a critical shortcoming of e-mental health solutions, this expectation is about maximizing the possibilities of the platforms and programs via personalization, customization, and gamification, especially for groups of users that welcome more possibilities, contents, and activities within the solution.
Uniqueness	**6**	A critical shortcoming in and an essential motivating factor for using e-mental health solutions, this expectation is concerned with providing information and guidelines to allow users to have a clear understanding about their capabilities and opportunities for improvement, the benefits associated with the solution and its activities, also the efforts and time required for achieving their optimal effects.
	7	An essential motivation for the users, this expectation is concerned with educating and providing adequate resources that will help users identify, anticipate, and track the changes (improvements or deterioration) in their mental and emotional well-being.

2.4.3 Desired User Experience from School-Based e-Mental Health Solutions

Consequently, in order to answer our third and final research question, the needs, motivations, and goals of adolescent users that could contribute towards making a more desirable user experience for universal school-based e-mental health solutions were identified. These contributing factors, which are outlined in Fig. 2, would be in fact the additional desires of adolescent students from using school-based e-mental health solutions. This means that for providing the desired user experience to adolescent users, first, the focus of HCI and UX designers and developers should be on meeting the user expectations (UE1–7), and then, on addressing the additional desirable factors (AD1–6); this way, when developing a new e-mental health solution or redesigning an existing one for high schools, developers and designers can focus on maximizing the likelihood that the experience of using their solution could be desirable for their intended users.

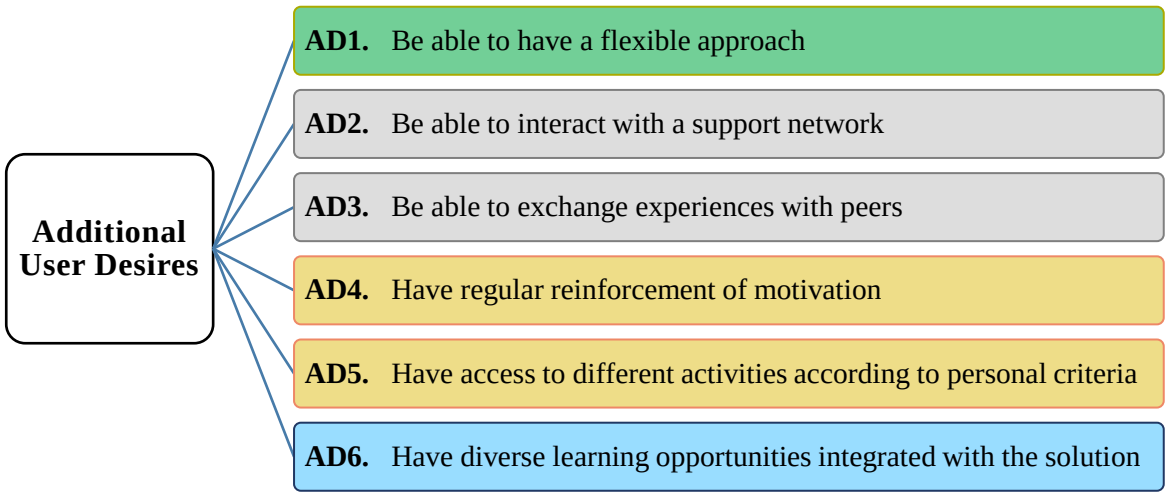


Fig. 2. Additional desires of users from using school-based e-mental health solutions. *Note:* Here, the color scheme for each additional desire corresponds to that of core users' needs depicted in Table 1.

The description of each additional desire from using school-based e-mental health solutions (AD1–6), its connection to the core user needs, and its practical implication for the schools and practitioners in the HCI and UX fields are presented in Table 3.

Table 3. Descriptions of additional user desires from school-based e-mental health solutions. *Note:* Here, the color scheme corresponds to the color schemes presented in Fig. 2 and Table 1.

Related Core Need	AD#	Description
Comfort	**1**	If this desire is met, users will be able to remove excess complexities and stresses that could follow if the solution is not easy to use and cannot be adapted to the users' schedules and preferences. Users desire to be allowed to use e-mental health resources and follow the programs at their own pace, within their comfort zone, and on their own (unaided).
Connection	**2**	If this desire is met, users will see more value in the solution as they would feel reassured to have access to a support system, which should consist of individuals who would understand the context and situation and would not be judgmental or critical of other users but could instead help alleviate stresses and complexities for them.
	3	If this desire is met, users will have feelings of belonging within a community and connections to those who are also in a journey with them, both of which will add to the subjective value of the solution and help motivate the users to use it more.
Variety	**4**	If this desire is addressed through motivational learnings, activities, messages, and any other means that can result in feelings of excitement for the users, it will increase the likelihood that the users would attempt to push themselves for getting more involved with e-mental health activities for the benefits and outcomes they could provide them.
	5	If this desire is met through customization capabilities that solution would provide to the users, they will be empowered to choose from activities they feel could be more valuable and suitable for them and to change and adapt program or activities' criteria (type of activity, level of complexity, etc.) based on their preference or need of the day.
Uniqueness	**6**	If this desire is met through delivering personalized educational contents and resources for the users who would welcome it, they will feel more knowledgeable and motivated than before in using the solution as they would associate more value to it.

2.5 Conclusion and Future Work

The presented article offers insights from an exploratory study that was conducted in order to better understand the factors that contribute to the overall user experience of universally delivered school-based e-mental health solutions from the point-of-view of adolescent users; more specifically, our research team sought to learn what kind of experience the users would expect to have from school-based solutions and how these solutions can become more desirable for them. Our findings were derived from conducting individual qualitative interviews with semi-structured questions from a total of 8 adolescent students residing in Canada who had (a) experiences with e-mental health resources (n=6), or (b) had experiences with non-digital mental health resources such as yoga and meditation practices (n=6), while these experiences were non-treatment-focused and were either through universal school-based programs (offered to all students regardless of their mental health risks) or through non-school-based activities and classes.

As our goal was to present this study's findings with practical implications that they would have for high schools, also the HCI and UX designers and developers in the most accessible way, our findings were organized and presented via interrelated visualizations (tables and diagrams): (a) first, the core user needs, or the underlying motivating factors that were identified to be the drivers of the users' expectations and desires from using e-mental health resources were outlined and defined in Table 1, together with the HCI and UX concepts which were deemed correlated to them; (b) then, the seven most essential needs, goals, and motivations that users expect to address through their experiences with e-mental health solutions were presented in Fig. 1 and their practical implications were discussed inside Table 2; and (c) lastly, six additional factors that could make the user experience of e-mental health solutions more desirable for their intended end-users were outlined in Fig. 2 and their practical implications were subsequently expanded inside Table 3. We recommend the developers and designers of school-based e-mental health solutions to first focus on providing what the end-users consider as the solutions' must-haves by addressing the seven user expectations, and then, to focus on offering the solutions' nice-to-haves by focusing on additional desires of users from using e-mental health solutions.

It is hoped that our results could be used as a means for HCI and UX designers and developers to help them put a more focused effort and create a better product or service strategy when developing or redesigning school-based e-mental health solutions and resources. However, it must also be acknowledged that due to the exploratory nature of our study, and since our focus was on better understanding the goals, needs, and motivations of the intended end-users of school-based e-mental health solutions through qualitative analysis, we can neither at this point provide concrete evidence about the feasibility of integrating our recommendations within a specific solution, nor attest to their consequent usability once they would be embedded within a school-based program; these concerns were beyond the scope of this research and could be further explored and tested via usability testing and other methods.

References

1. Statistics Canada: Impacts on Mental Health (2020), https://www150.statcan.gc.ca/pub/11-631-x/2020004/pdf/s3-eng.pdf, last accessed 2022/02/10

2. Statistics Canada: Canadian Health Survey on Children and Youth (2020), https://www150.statcan.gc.ca/n1/daily-quotidien/200723/dq200723a-eng.htm, last accessed 2022/02/10

3. American Psychological Association: Stress in America™ 2020: A National Mental Health Crisis (2020)

4. Fisak B. J., Richard, D., Mann, A.: The prevention of child and adolescent anxiety: A meta-analytic review. Prevention Science, 12 (3), pp. 255-268 (2011)

5. Neil, A. L., Christensen, H.: Efficacy and effectiveness of school-based prevention and early intervention programs for anxiety. Clinical Psychology Review, 29(3), pp. 208–215 (2009)

6. Tedder, M., Shi, L., Si, M., Franco, R., Chen, L.: eMindfulness Therapy—A Study on Efficacy of Blood Pressure and Stress Control Using Mindful Meditation and Eating Apps among People with High Blood Pressure. In: Medicines 2, pp. 298–309 (2015)

7. International Organization for Standardization: Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems (2019), https://www.iso.org/obp/ui/#!iso:std:77520:en, last accessed 2022/02/10

8. McQuivey, J.: Digital Consumers Want to Fulfill Their Needs. In: Digital Disruption: Unleashing the next wave of innovation. Forrester Research, Inc., pp. 54–68 (2013)

Chapter 3: Article:
Facilitating Engagement Through the User Experience of Universal School-Based Digital Mental Health Solutions

A Qualitative Exploratory Study

Erfan Badawi*, Constantinos K. Coursaris, Sylvain Sénécal and Pierre-Majorique Léger
HEC Montréal, Montréal, Quebec, Canada

* erfan.badawi@hec.ca

Keywords: mental health, digital mental health interventions, adolescents, high school, qualitative, exploration, user experience, user engagement.

Abstract

Digital mental health intervention (DMHI) programs offered in schools present a crucial and inexpensive investment, also a readily-accessible and flexible means for educating, empowering, and supporting adolescents in maintaining a balanced mental health during uncertain and stressful times such as COVID-19 pandemic. Recent studies indicate that for DMHI programs to be effective in improving students' mental well-being and in preventing from their mental health complications, user engagement is key. This study focuses on identifying the factors pertaining to user experience of digital solutions that can facilitate user engagement with DMHI programs that schools deliver universally to their students, regardless of their mental health conditions. To identify said factors, we sought to gain a deeper understanding of perceptions, opinions, and preferences of the actual end-users (i.e., the adolescents) regarding their experiences with both digital and non-digital mental health resources and thus investigated what constitute the primary user expectations (or a digital solution's *must-haves*) and the additional user desires (or a solution's *nice-to-haves*) that contribute to engagement with universal school-based DMHI programs. Specifically, through conducting interviews with adolescents who had either a higher-than-average or a lower-than-average engagement with universal DMHI programs of a specific school-based digital mental health solution, also adolescents who had voluntarily used non-digital or non-school-based digital mental health resources for purposes other than treatment, the reasons that could lead the adolescents to better engage with school-based DMHI programs, as well as the shortcomings that could prevent that from happening were uncovered. By performing a thematic analysis, the most important (or primary) and the additionally desirable (or secondary) factors that that could lead to a higher engagement level for school-based DMHI programs were identified. Lastly, using the gathered evidence from our interviews, specific recommendations are proposed that could help in targeting each identified engagement factor and in increasing the likelihood that school-based DMHI programs achieve their desired outcome for high school students.

3.1 Introduction

The adverse effects of coronavirus disease pandemic on public health have invited a renewed attention toward adolescents' access to mental health resources, support, and education. As recent public health studies and surveys on mental health in North America indicate, adolescent students are in an alarming mental health condition, especially due to lack of in-person interactions and the uncertainties that have resulted from measures such as lockdowns and schools' closures that were intended for preventing the spread of coronavirus disease, i.e., COVID-19 (1–2). The decline in mental health conditions has not only affected the overall health of adolescents, but also has caused adverse social outcomes, such as lower school grades and difficulty in making friends (3). Even though evidence strongly suggests mental health of adolescents requires immediate attention, however, not only the younger generations lack access to both mental health resources and education (4), but also "mental health" is still a topic that cannot be openly discussed; as research shows, there are still generally negative perceptions and stigma associated with adolescents seeking professional help for mental health concerns and problems (5). For these very reasons, it would be up to the schools to act as a mental health resource center and educator for adolescents as the school system has long been identified not only as the single location that the majority of adolescents and children can be reached (6), but also as a crucial avenue for identifying and addressing students' mental health needs (7).

Evidence has shown that schools are environments where universally delivered mental health intervention programs can be effective in achieving their goals (e.g., anxiety and depression prevention) and in improving adolescents and children's overall mental well-being (8–10). In contrast to the "selective" and "indicated" types of mental health intervention programs—collectively referred to as "targeted" programs—which high schools design for more at-risk groups or those individual students who show symptoms of a mental health disorder, "universal" mental health intervention programs are designed for and delivered to either all the students of specific grades or throughout the school (11). Therefore, compared to the targeted methods, universally delivered programs are not only more accessible, more cost-effective and much easier to implement (12), but also are perceived to be much less stigmatizing since the individual students are neither singled-out nor forced to participate in a mental health program (11). Furthermore, through universally delivering a digital mental health intervention (DMHI), schools can allow their students to have a costless, flexible, and readily available access to a collection mental health-related learning activities, practices, and other resources such as mental health support services (13). As digital technology (such as online platforms, mobile and wearable digital devices, and smartphone and computer applications) is used for developing digital solutions to act as the primary or the supplementary method of delivering mental health intervention programs, this method has additional crucial advantages over non-digital methods of intervention including reduced stigma associated with receiving or using a mental health support system, more privacy and anonymity for students, less training and preparation required for staff, and more flexibility and consistency in delivering mental health resources to students (14). All the mentioned benefits that could result from universal school-based DMHI programs could potentially lead to more student engagement than the non-digital programs and could maintain the interests and the involvements of these adolescent users throughout the intervention (14).

User engagement with digital technologies that are used for intervention to promote self-management, self-monitoring, and behavior changes—similar to the features, qualities, and objectives of high schools with universal DMHI programs—has been conceptualized by Perski et al., through forming an integrative definition based on a systematic review of 117 qualitative studies about engagement with digital intervention methods, as a dynamic process (i.e., it varies within individuals over time) underpinned not only by behaviors (such as the amount, frequency, and duration of use), but also by subjective experiences of the users, within their contexts of use (15). Recent studies have all signified that it is vital to focus on improving the users' engagement with DMHIs. Findings from a scoping review of 16 studies on user engagement with DMHIs in "nonclinical" settings (i.e., not designed for actual patients or persons undergoing a treatment) have indicated that for DMHIs to be effective for nonclinical users in improving their psychological well-being, optimal user engagement is critical (16). Also, results from a recent narrative review of 35 studies pertaining to the effects of engagement with DMHIs have revealed that, regardless of the types of intervention or the mental health condition of the target users, higher levels of user engagement with DMHIs were associated with moderate improvements in mental health outcomes for the users compared to lower engagement levels (17). The studies included in the mentioned studies were however primarily concerning the adults aged 18 and above, and outside the school environment; specifically, there were only 5 studies that included school-aged children and adolescents while none had particularly focused on adolescents or high school students. In a less recent systematic review of relevant literature concerning adolescents, researchers had also invited similar attention towards user engagement with DMHIs; in their systematic review of school-based and college-based DMHI programs for young people aged 12–25, Clarke et al. (18) have concluded that DMHIs have positive impacts on adolescents' mental health and well-being, but low levels of engagement and program dropouts have been significant issues affecting many interventions in the past.

As we found a gap in recent academic literature, finding no recent primary research that explored the perspective of high school students to identify the factors that could lead to a more engaging user experience with school-based DMHI programs, we sought to investigate and better understand the adolescents' subjective experiences, opinions and preferences surrounding digital mental health resources and to uncover their needs, expectations and desires from universal school-based DMHI programs. To this end, two sets of qualitative interviews, each consisting of 8 individual interviews were conducted with a total of 16 high school students: (a) the main participant groups were users with higher-than-average (n=4) or lower-than-average (n=4) level of engagement with universal school-based DMHI programs. Our goal with these interviews was to gather insights surrounding the reasons that have led and could lead the users to better engage with school-based DMHI programs, as well as the shortcomings that prevented and could prevent that from happening; and (b) the supporting participant groups were adolescents who had used non-school-based digital mental health resources (n=6) or non-digital mental health resources such as yoga and meditation classes (n=6), all in nonclinical settings and through adolescents' voluntary use or participation. With this set of interviews, in which four participants answered to questions pertaining to both digital and non-digital resources, our goal was to gather more insights into adolescents' needs, expectations and desires from digital mental health solutions and to gather more evidence about the factors that could drive adolescents' engagement with school-based DMHI programs.

To focus our efforts on this exploration, specific research questions were identified, all of which will be answered using thematic analysis of the gathered qualitative data:

RQ1: What are the factors related to user experience of digital mental health solutions that drive the engagement of frequent adolescent users with DMHI programs?

RQ2: The absence of which factors related to user experience of digital mental health solutions lead to a lack of engagement with DMHI programs for infrequent adolescent users?

RQ3: What factors related to user experience of digital mental health solutions facilitate adolescent users' engagement with universal school-based DMHI programs?

With the first and second research questions (i.e., RQ1–2), our intention was to conduct in-depth investigations into experiences, opinions and preference of the actual users of universal school-based DMHI programs in order to identify which addressed or unmet needs, expectation and desires of the users had resulted in their increased engagement or disengagement with DMHI programs. For answering the third research question (i.e., RQ3), which is, in fact, the principal research question guiding our efforts, we aimed to gather more data from a supporting set of interviews to account for discrepancies other than past experiences (positive or negative) with universal school-based DMHI programs through investigating adolescents' relevant experiences with other mental health resources, also their opinions and preferences regarding universal school-based DMHI programs.

By integrating and analyzing our collected data from the main and supporting participant groups, enough evidence and robust insights into adolescent students' needs, expectations and desires pertaining to the user experience of universal school-based DMHI programs were captured. These identified user needs, expectations and desires are effectively the factors that—if addressed—could facilitate adolescents' engagement with DMHIs. Through identifying these factors, we contribute to human-computer interaction (HCI) and user experience (UX) fields and potentially help the developers of nonclinical DMHIs with increased likelihood that their universally delivered school-based DMHI programs could be effective and beneficial for the mental health of their high school students.

3.2 Methods

3.2.1 Context

To answer our research questions, exploratory interviews were conducted with adolescent users of universal school-based DMHI programs as well as users of non-digital and non-school-based digital mental health resources. Individual semi-structured interviews were performed as their benefits heavily outweighed following structured or non-structured types of interviews, also interviews with more than one participant; this method could provide us with more flexibility in our exploration and more opportunities for probing, thus help us uncover more insights into individual experiences and more evidence regarding the factors that contribute to user engagement than the other methods (19).

For determining a sampling method for our main participant groups, i.e., users with higher- or lower-than-average engagement with universal school-based DMHI programs, Perski et al.'s conceptual framework for engagement with digital interventions was used: "User Engagement" is conceptualized as a dynamic process and defined as a bidimensional construct relying both on the usage behavior and on the user's subjective experience, within the context of use (15). As our aim was to qualitatively explore subjective experiences of adolescent users to reach our research goals, our exploration was therefore focused toward two extremes of the usage behavior spectrum, meaning only users who had either high-frequency or low-frequency usage, and for one particular local digital mental health solution. The users of one particular local solution were chosen in order to limit major discrepancies in the settings pertaining to DMHI programs' contexts of use that could have introduced contextual differences in the users' perceived experiences and opinions; these settings according to Perski et al.'s framework (15) would be underpinned by the users' social environment (e.g., culture, social norms, and media) and physical environment (e.g., location, healthcare system and policy, access to high-speed internet and hardware). In addition, since according to the framework, the optimal level of engagement (or *optimal dose*) at which an intervention program would be effective is specific to and defined for a particular digital solution, a specific digital mental health solution was chosen and focused on in order to investigate the factors that have led the users to have a lower or a higher engagement than this solution's optimal dose.

Description of the chosen local digital mental health solution. The specific digital mental health solution that was selected for our study, which for the purpose of confidentiality will remain unnamed, was at the time of our study offering universal DMHI programs to select high schools and colleges across Quebec, Canada, from which our research only focused on two high schools (a private school and a public school) located in southwestern Quebec. This solution consisted of a web-based platform that provided weekly- and monthly-themed mental health intervention programs throughout the schoolyear for students who would voluntarily register for them. The solutions' DMHI programs that were designed with and specifically for high schools were focused on demystifying "mental health" for students, reducing their psychological distress, and improving their overall well-being. Each of these DMHI programs consisted of a variety of activities presented within a gamified, step-by-step setting (i.e., completion of each activity gives points to the participating student); the platform also provided a dashboard for students so they could monitor their progress and performance, and leaderboards for comparing their performance statistics with those of other peers. The programs' activities included educational presentations (including readings and videos), recreational slides, quizzes, etc. that were all circled around the specific theme of a weekly or monthly program, such as "pressures of student life", "self-acceptance", "anxiety", "physical health", etc. Many of these programs were embedded with short surveys that acted as a preventive means for reporting the students' overall mental health condition, anonymously, back to their schools, also for identifying and monitoring individuals in critical states who would require urgent interventions from their trusted contacts, school personnel, or relevant authorities.

3.2.2 Recruitment and Participants

Through purposive sampling, for the main set of interviews, adolescents who were studying at one of our two targeted high schools and had a noticeably high or low level of engagement with the chosen local digital mental health solution were targeted, and for the supporting set, adolescents residing in Canada who had voluntarily used or followed non-digital mental health resources (such as yoga, meditation, and mindfulness classes) or non-school-based digital mental health resources (such as digital tools and applications for anxiety- and stress-relief, sleep aid, mental focus, etc.). The research protocol and interview guides for each participant group were submitted along with other necessary documents for the approval of our institution's Research Ethics Board (REB). In order to receive consents for participation in our research directly from adolescents and interview them without an adult or guardian being present, as their presence alone could have influenced our discussions, our data collection was restricted[4] to focus only on adolescents aged 14 and above, equivalent to high school students in grades 9–11 in Quebec, Canada.

After receiving the certificate of approbation for our project from REB, the recruitment process commenced in late-spring 2021, close to the local high schools' final examination period. First, the directors of the selected digital mental health solution were contacted in order to help the research team find potential participants for the main set of interviews based on their solution's indicators for engagement, which accounted for cumulative time and number of logins, number of completed activities and sessions, also number of days passed since registration for each user: (a) the top 5% of students aged 14 and above with the best indicators for engagement were targeted as "frequent users" of the solution's DMHI programs; and (b) the top 5% of students aged 14 and above with the worst indicators for engagement were recognized as "infrequent users" of DMHI programs. A total of 33 potential participants met the criteria per each group. In parallel, the search for potential participants that would meet the criteria set for the supporting groups (i.e., having past experiences with non-school based digital mental health resources or with non-digital mental health resources) carried out through either contacting a network of local high schools for sending our invitation letters to their students or posting "call for participants" messages on social media platforms. All the potential participants for the main and supporting participant groups were asked to have a good recollection about their experiences with their resources for participating in our interviews, for which they would also receive a fixed monetary allowance.

A total of eight participants who all self-identified as female were recruited as part of our main participant groups: (a) four frequent users participated in our interviews, half of which were from the same private school and the other two participants were from the same public school; there was one student in the ninth and one student at the tenth grade level from each of these high schools, and (b) four infrequent user participated in our interviews, all of which were studying at the same private school; only one participant was from the tenth grade level, while the other three were studying in the ninth grade level. Overall, from the eight participants recruited for the main set of interviews, five (62.5%) were studying in Grade 9 and others (37.5%) were students in Grade 10 level in Quebec, Canada. This is while

[4] This measure was put in place to comply with Section 21 of the Civil Code of Québec (chapter CCQ, c. 17, s. 2), in which it is stated that only minors aged 14 and above could give consent alone with the condition that a competent research ethics committee would judge the circumstances justify involving them.

only two students were studying at a public high school (25%), as the others were students at a private high school (75%).

In addition, eight adolescents who were current or past students at high schools in Quebec were recruited for our supporting set of interviews, half of which were students at public and the other half at private high schools. Most participants identified themselves as female (75%), and only two as male (25%). Also, four adolescents (50%) recruited for these interviews met both criteria and responded to our questions about their experiences with both digital and non-digital mental health resources during the interviews, with slightly extended duration. Overall, there were (a) six adolescents who met the criteria for non-digital mental health resources, out of which three were students at public high schools where they had taken in-person, non-mandatory mental health courses, and the other three were students at private high schools, all of whom pursued mental health practices such as yoga and meditation outside the school environment and on their own accord; and (b) six adolescents who had voluntary experiences (without an intervention from a professional or organization) with non-school-based digital mental health resources for different reasons such as stress- or anxiety-relief, increasing their focus or sleep quality. Half of the adolescents (3 out of 6) from this category were students at private schools and the other half at public schools.

On the whole, combining the data from participants recruited for all participant groups resulted in having a total of 16 participants from which two participant self-identified as male (12.5%) and 14 as female (87.5%), six were students at public high schools (37.5%) and 10 at private high schools (62.5%), while also 10 students (62.5%) were studying in the Grade 9 and the other six (37.5%) were students in Grade 10 level (see Supplementary Table A).

3.2.3 Procedure

All the interviews were held online and via Lookback's interview moderation platform[5] (Lookback Group Inc., Palo Alto, CA). The allocated time for each interview was announced to be between 30 to 50 minutes, depending on how the discussions would unfold; however, almost all interviews lasted between 30 to 40 minutes except for those adolescents who answered questions pertaining to both digital and non-digital mental health resources, for whom the interviews lasted close to 50 minutes. The interviews were conducted by one principal interviewer and one notetaker. The research team deemed having a notetaker present during each interview was necessary; since due to ethical considerations and for respecting the privacy of the adolescent participants, only capturing the audio from the individual interviews was possible, an important role of the notetaker[6] was thus to look closely for and to detail the contextual and non-verbal cues (such as a change in facial expression, posture, or body language), which were very integral for uncovering what was not explicitly expressed by participants or remained latent needs and therefore unknown to them (20); in addition, due to the semi-structured and exploratory aspects of the interviews and the sensitivity of the subject, the notetaker was instructed to intervene whenever a key probing opportunity would be missed and not used by the principal interviewer, or whenever nonverbal cues could indicate that the existing topic of discussion must be abandoned in favor of another topic.

[5] https://www.lookback.com/

[6] Four volunteer students from our institution who were authorized by REB to participate in our research helped in both notetaking roles and also conducting the interviews.

All the participants were asked to give their consent—a written consent prior to the day of interview and a verbal confirmation of their consent at the beginning of interview—for participating in our study. As it was planned in our semi-structured interview guides, during each individual interview and from each participant, open-ended questions were asked which followed the techniques for gathering user needs' data that were common practice in user needs research and design thinking methodology (21): As the starting point, the aim of our questions were to understand "when", "why", and "how" each student had used either a specific aspect of the chosen digital mental health solution (for the main participant groups) or a digital/non-digital mental health resource (for the supporting groups); then, further elaborations and clarifications were requested from each participant regarding what they liked and disliked about their experiences; and lastly, participants were asked what they believed to be the shortcomings in each aspects of their experiences—while the users of non-digital resources were inquired about what they perceived or believed digital mental health resources lack compared to the non-digital resources—and what their recommended improvements were for addressing them.

To better answer our two research questions from the main participant groups, specific topics and aspects were selected to be the focus of the interviews' open-ended questions: (a) the learning materials and activities within the programs in which the users had participated, (b) the relevance and depth of the offered themed programs and activities, (c) the individual dashboards and overall leaderboards, (d) the announcements (general and program-specific), and (e) the gamified aspects of the web-based platform. As it was intended that our discussions encompass as many factors as possible pertaining to user experience of this particular solution, discussing all these topics and delving deeper into each topic helped us better investigate adolescent students' perceived experiences, also their expectations and desires from using the platform, its programs and features.

3.2.4 Data Analysis

To combine our interview findings from both main and supporting participant groups in order to discover more credible evidence and more insights into user engagement factors for DMHI programs, a similar procedure was developed for analyzing all the conducted interviews. Our procedure was developed based on the analysis procedure that is common practice in user needs research and design thinking methodology's "Define" phase (21), while closely following Ulrich & Eppinger's recommended qualitative analysis steps for identifying the users' needs (20, p. 82–87): (a) after each interview, the interview transcript was developed in the language that the interview was conducted—as the participants were given a choice between English and French, the official languages in Canada—and subsequently, the pertinent contextual and non-verbal cues and insights, which were captured by the notetaker were added into the transcript, (b) after developing all the transcripts, anonymizing the individuals to protect their privacy, and copying all the transcripts related to each group—between the frequent users, infrequent users, digital users, and non-digital users—in separate word-processing documents, an inductive approach was used wherein each sentence within the transcripts (whether it was expressed by the user or added by the notetaker) that would represent a user need would be transformed into phrase(s)—as some sentences could represent more than one user need—representing the need from user's point-of-view (i.e., in the format of statements such as "I would like to be able to set clear

expectations before using a mental health application."), and (c) after transforming all the transcripts into phrases that represented user needs, first, similar phrases expressed by the same participant were omitted; then, the remaining similar phrases were analyzed: The most representative phrase between similar needs was kept, the count of similarities to that phrase was noted via a numerical value before the other phrases were discarded, however, if no single phrase could represent all other similar phrases, a new phrase was generated to represent the theme shared among similar needs, and those needs were then listed via bullet points under the new phrase; where applicable, to keep the count of total similar user needs, the numerical values associated with the phrases that were being discarded were added together and the total value was noted next to the new phrase. This thematic analysis along with the statistical calculation of the number of occurrences per each theme, especially for the main participant groups, helped us pinpoint some of the most important factors related to user experience of digital mental health solutions that could influence the users' paths toward a high or a low level of engagement with the school-based DMHI programs.

After the completion of data analysis for each participant group, the following procedure was developed in continuation of the last procedure in order to combine and analyze all the collected data together: (a) first, phrases from all the participant groups were copied within an online whiteboard platform, inside separate text boxes, (b) then, all the text boxes were color-coded in order to differentiate which phrases belonged to the main and which ones to the supporting participant groups, (c) next, all the phrases of the main and supporting groups were combined together via the following steps: For those phrases that had similarities with each other, if there was a phrase representing similar phrases, that phrase was kept, the color of its text box was changed to a new one representing that the need is shared by all participant groups, and other phrases were then discarded after the count of similar ideas were noted next to the kept phrase via a numerical value (while taking into account the numerical values that were previously associated with the individual phrases that were discarded); if there was no phrase that represented all other similar phrases, a more representative phrase was generated inside a new text box with the color that represented all groups, then, count of similar ideas were added together with the numerical values associated with them, and next, the total count was noted next to the new phrase and similar phrases were added via bullet points under it; for the phrases that had no similarities with each other, they were kept as they were at this stage of analysis, (d) the phrases that either had the most occurrence (by considering the numerical counts and the number of bullet points associated with each phrase) or had the most urgency (i.e., the weight or the priority of such topics were acknowledged either by the adolescent participants themselves, through explicitly or implicitly emphasising on the matter, or by the research team based on the topic's sensitivity and the gravity of its positive or negative effects)—a step that required revisiting all the annotated transcripts—were identified and kept, and other phrases were all discarded; by only keeping the phrases that had the most occurrence and the most urgency, the user needs that were most likely to influence the users' experiences and engagement levels with DMHIs were identified, and (e) whether the remaining user needs could be categorized as a user expectation or an additional desire from using a digital mental health solution was investigated; as *user experience* is defined by the International Organization for Standardization (ISO) as the "users' perceptions and responses that result from the use or anticipated use of a system, product or service"

(22), discovering what adolescents expect (i.e., perceive as a digital mental health solution's "must have") or additionally desire (i.e., perceive as a digital mental health solution's "nice-to-have") to be addressed via their experiences with DMHI programs was a key step in our analysis as they have direct influences over the perceived user experience of school-based digital mental health solutions.

Following the identification of users' expectations and additional desires, two models were adopted and used for further classification of our findings: (a) McQuivey's *four fundamental human needs* model, in which the fundamental needs of "comfort", "connection", "variety", and "uniqueness" are claimed to be the factors affecting the individual behaviors of digital users (23, p. 61) was adapted to be used for identification and classification of the users' underlying needs, and in other words, for explaining what fundamental needs motivate the adolescent users to expect or to additionally desire certain features, functionalities, or benefits from digital mental health solutions. In our adaptation and based on the links found between our findings from the interviews, the research team defines *comfort* as the users' need to remove complexity, ambiguities and any sources of stress that user experience of digital mental health solutions could bring, as many similar instances were found within our findings, such as our participants' demands for psychological safety and ease-of-use; *connection* as the users' need to belong with their peers and to feel part of the community as these needs greatly influenced how our participants judged the usefulness of the digital platforms they were using; *variety* as the users' need for anticipating novel experiences, untapped possibilities and diversions from boredom, all of which were uncovered as the underlying needs of our participants when demanding or wishing for more personalization, customization and gamification within digital solutions; and lastly, *uniqueness* as the users' need for individuality, self-acceptance, and personal development, which were found to be the drivers behind our participants' expectations and desires for having opportunities for improving their self-efficacy, self-reflection, and knowledge, respectively (23, p. 61–65); and (b) Goodhue & Thompson's *Technology-to-Performance Chain* (TPC) model (24) was used to categories the identified users expectation and desires. To this end, whether each user expectation and desire would be concerned with the individual, technology, or task characteristics was investigated; according to TPC model, technologies could lead to performance impacts at the individual level when they would be utilized by the individual users and would fit the user task that they support (i.e., achieving a task-technology fit); our aim with this last step of analysis was to present how developers of digital mental health solutions could target users' expectations and desires: through technology characteristics, meaning the aspects or functions related to the systems, hardware, software, training, user support services, etc. (24); through task characteristics, i.e., aspects related to the physical and cognitive actions and processes required from individuals who utilize the technology in their environments (25); or through adapting or extending their technology and task characteristics to become compatible with individual characteristics of the users, such as their familiarity and experiences with the technology or the tasks it supports, their motivations to utilize the technology or to perform a task, etc. (24).

3.3 Results

3.3.1 Key Themes Emerged for the Main Participant Groups

In this section, our key findings for the main participant groups, each derived from the themes emerged after organizing the user needs based on their frequency of repetition and urgency, will be presented. Also, the answers to our first two research questions will be revealed when discussing the key themes found per each user group.

3.3.1.1 Themes Found for Frequent Users

The main expectations and additional desires of the users with higher-than-average engagement (labeled H1–4) from using digital mental health solutions, and in other words, the main factors driving the users to better engage with DMHI programs (i.e., the answer to RQ1), along with key quotes from the interviews were identified as follows:

H1: Adolescent users want to be able to adapt the programs and activities to their schedules and realities: **(A)** users expect to be empowered with the ability to scale up, pause or scale down their progress through adjusting the speed, volume, and difficulty level of their activities, where applicable. All the frequent users (4 out of 4) claimed they were willing to do more activities when that they had less homework and were less busy, but no time-consuming activities during the final weeks of the schoolyear, as they would have neither time nor a proper focus to put for anything other than their final examinations; and **(B)** users expect to be presented with learnings and activities that would have real-life application for them. Half of the users (2 out of 4) expressed they required realistic applications for their learning activities, with recommended steps for applying them in practice. About the instructions on how to complete certain activities, participant P3 (female, aged 15–16) mentioned: “I try to follow what they say, but sometimes, some challenges are hard to achieve. They're things you don't normally do”.

H2: Adolescent users want incentives for participation in DMHI programs: **(A)** users expect to feel connected with others and encouraged through social connections within the digital environment. Majority of the users (3 out of 4) strongly felt having a platform to discuss with peers or their friends about their shared activities and readings could be very motivational. Particularly, participant P2 (female, aged 15–16) emphasized on the importance of having a mental health discussion forum with her peers: “There are no Quebec websites, to my knowledge, where you can talk with teenagers that lived through same things [problems], understand how they deal with it … preferably anonymously, even moderated, in case someone was sharing dangerous or suicidal thoughts!”; **(B)** users desire to receive timely and clear announcements about upcoming programs and activities. Regarding announcements of the upcoming learning topics and activities, while one user welcomed the surprise effect of not knowing about them in advance, half of the users liked to be informed beforehand so they could anticipate them or get excited about them. As participant P4 (female, aged 14–15) points out: “It would be nice to have a schedule to know when and what activity is coming out instead of just

waiting to see [new announcements] on an email" [translation from French]; and **(C)** users desire to receive motivational newsletters and emails. Half of the users felt the platform's newsletters and emails should be accompanied by a form of uplifting or motivational messages as having announcements alone were often not enticing enough for participating in the current or upcoming weekly- or monthly-themed activities.

H3: Adolescent users want to have access to comprehensive information within the digital environment: **(A)** users expect to be provided with access to professional help. Most users (3 out of 4) felt they should learn how to receive help and also have instant access or link to professional support, should the need arise. Through asking a rhetorical question, participant P1 (female, aged 14–15) called attention to the importance of this matter: "Seeking help and seeing a psychologist is still a taboo, but [how so] having problems is not?" [translation from French]; **(B)** users desire to have access to in-depth learning opportunities surrounding mental health topics or to know how they can learn more about them. Half of the users wished to have more comprehensive information about the mental health-related topics presented within the programs, and if not possible, learn how to acquire the knowledge on their own; and **(C)** users desire to learn more about the sensitive topics that are relevant to them (such as addiction, abortion, etc.). The offered DMHI programs were believed to only scratch the surface of sensitive and taboo subjects rather than providing a thorough and detailed examination of them which half of the users would have preferred. As participant P1 clarifies: "The programs helped me in a way because they taught me about addiction, love, etc., but I don't know if they really *helped* [emphasis added] me" [translation from French].

H4: Adolescent users want to practice self-reflection and introspection through different topics and activities: **(A)** users desire to have access to a variety of activities and learning materials that encourage self-reflection. Half of the users acknowledged learning about different topics and having access to various contents were nurturing as they allowed them to examine themselves through different lenses and ponder on certain subjects and questions for the very first time; and **(B)** users desire to have access to self-assessment and self-reflective questionnaires and tests, as half of the users claimed they helped them reflect and understand more about themselves. Particularly, participant P4 acknowledged why and how the questionnaires are helpful: "I like questionnaires. They allow us to be more involved. It's a kind of feedback about ourselves: how we feel, how we act in certain circumstances … these [types of] questions are deeper compared to what we, on ourselves, would think about" [translation from French].

3.3.1.2 Themes Found for Infrequent Users

The main expectations and additional desires of the users with lower-than-average engagement (labeled L1–4) from using digital mental health solutions, and in other words, the main factors that their absence have led and could lead the users to disengage from DMHI programs (i.e., the answer to RQ2), together with key quotes from the interviews with this user group are detailed in the following lines:

L1: Adolescent users want to have psychological safety when using a digital mental health solution: **(A)** users expect to feel free to use the digital solution and follow its programs. The solution's features and facets (including those of its themed DMHI programs) were deemed not inviting and personal enough according to half of the infrequent users (2 out of 4) as they saw the programs and activities more like their homework rather than exercises to help them; and **(B)** users expect to feel at ease when they cannot follow the DMHI programs. Half of the users demanded having the choice to not get included within comparison and competitive features of the platform such as leaderboards; they felt an immense pressure after discovering they were being compared with others, as they believed their varying availabilities, challenges and pressures in daily life did not let them pursue the programs regularly or with the consistency that they wished.

L2: Adolescent users want access to personalized contents and activities: **(A)** users expect to know if the program would be able to help them, and how. Majority of the infrequent users (3 out of 4) felt the programs' activities were not necessarily targeted for them and they had to do them without understanding what their benefits were or how they can receive them. As participant P6 (female, aged 14–15) ascertained: "If these [kinds of] programs can explain how it can help young people in the first place, surely young people will relate to it more" [translation from French]. In addition, participant P7 (female, aged 14–15) further elaborated on why she felt that something was lacking: "I remember a text [titled] 'what is love?', with examples of couples … I don't learn anything [from it]; I don't feel challenged! I didn't think '*Oh, I learned about love, I should now see what it means in my life!*' [emphasis added]"; and **(B)** users expect to have the ability to choose from a range of topics and activities and to select the ones that would be (more) appropriate or applicable to them. Half of the users required but were not given the ability to choose the activities they wanted and the ones they did not want to participate in for the duration of themed programs. As participant P6 articulated how she wanted to use the solution: "I would have liked it to be separated into sections, so I could pick only the contents that are relevant for me" [translation from French].

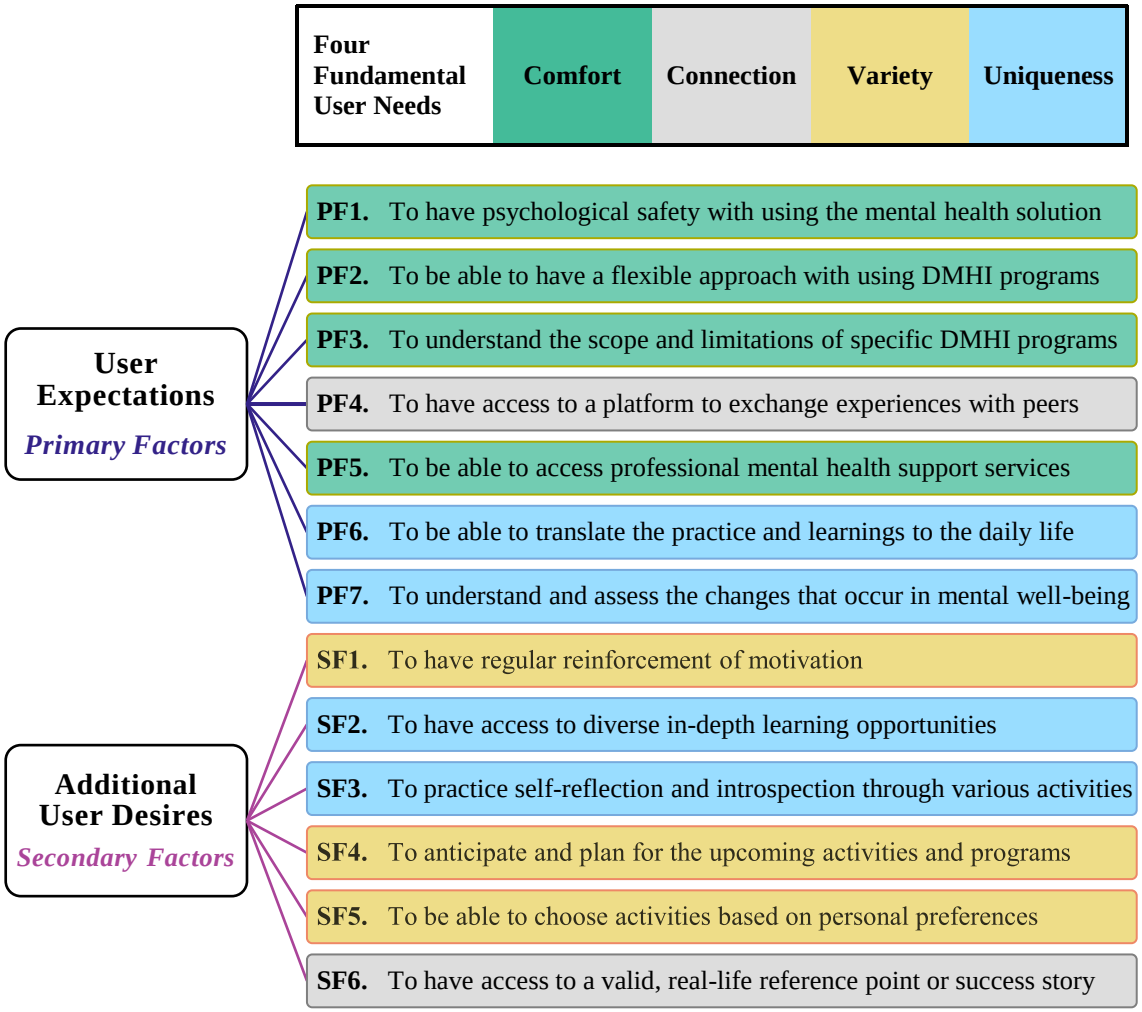
L3: Adolescent users want to have incentives for participation: **(A)** users expect to have access to a platform where they could discuss with other peers. All the infrequent users (4 out of 4) required to be able to communicate with other young people through the digital platform, especially with other students or friends who experienced the same things. Particularly, participant P5 (female, aged 14–15) was adamant about this request: "Talking with other people with the same age who have been through the same things as you, *that* [emphasis added] is better than talking with adults" [translation from French]; and **(B)** users desire to receive follow-ups on past activities and learnings they had completed in order to feel or realize how much they have grown since the last time and to continue their progress. Half of the users felt discouraged to continue using the programs as they felt their prior efforts were not accounted for.

3.3.2 Emergent Themes from Combining Data from All Participant Groups

After analyzing the combined data from all 16 participants that were interviewed as part of the four groups, the most important user expectations and the most prominent additional user desires from digital mental health solutions were identified (see Figure 1). Then, the identified user expectations, which we recognize as the *primary factors* related to user experience of DMHIs that facilitate engagement (labeled as PF1–7), and additional user desires, which act as *secondary engagement factors* with DMHIs (labeled as SF1–6) were linked to our adapted concepts from four fundamental human needs model and are presented—via the same color scheme for the purpose of clarity—in Figure 1.

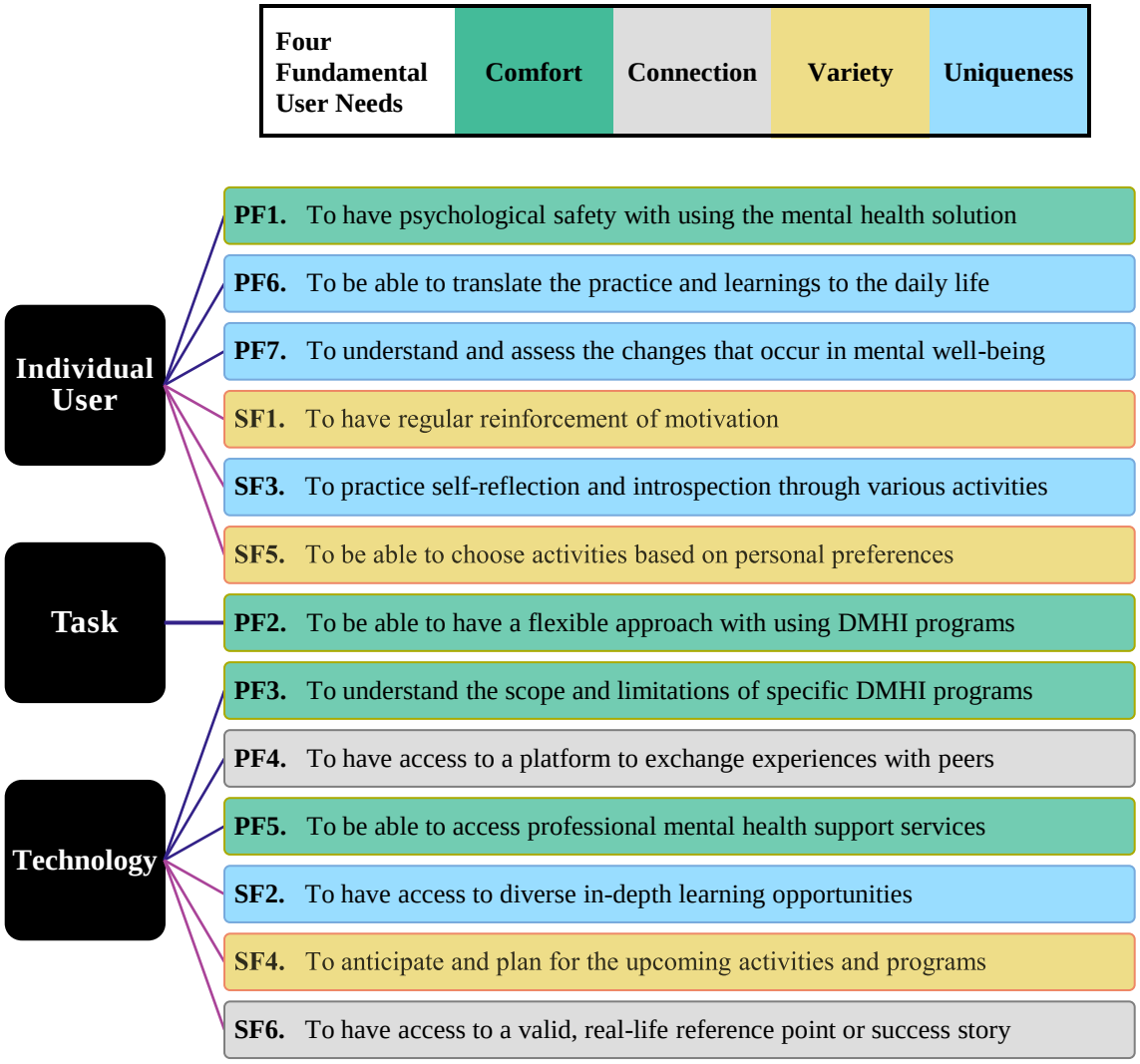
As apparent from Figure 1, all the user needs that were concerned with users' pursuit for comfort fall into primary factors of engagement, as they were the least of—and the most important—expectations of the users from using school-based DMHI programs: having psychological safety (PF1) and a flexible approach (PF2) in following the DMHI programs and when needing a professional support (PF5), also understanding what they can learn from and can accomplish by following a specific program (PF3). As it can be observed from Figure 1 as well, those needs of the users that were concerned with their search for variety fall into secondary engagement factors as their fulfillment were considered to be very desirable and motivating, but not an absolute necessity: having regular reinforcement of intrinsic and extrinsic motivation (SF1), building anticipation for possibilities in the future (SF4), and being able to progress in the programs while having the freedom to choose from activities based on personal preferences (SF5). Furthermore, striving for connections was not the underlying reason behind one of the most repeated requests among the main participant groups (i.e., the identified factors H2A and L3A), but also fall into both primary and secondary user engagement factors with DMHIs: The users' need for connections not only accounts for their expectation of having access to a peer discussion platform (PF4), but also represents their desire for having access to or following real-life examples as their reference points (SF6), in pursuing the betterment of their mental health. Lastly, the user needs that were concerned with appreciating the individuality and uniqueness of oneself were responsible for the last primary engagement factors (namely, the users' need to be able to adapt the mental health-related activities to their daily life [PF6] and their need for understanding the changes that can occur in their mental well-being and learning how to assess these changes [PF7]), as well as the most important secondary factors (namely, the need for having a variety of opportunities for self-improvement [SF2], also for self-reflection and introspection [SF3]).

Figure 1. Primary and secondary factors influencing user engagement with DMHIs. *Note*: The color scheme of each primary factor (PF#) and each secondary factor (SF#) corresponds to the color scheme representing the four fundamental user needs.



To inform the user experience of school-based DMHI programs, Goodhue & Thompson's TPC model (24) was integrated to our findings so it could be determined which dimension between technology, task, and individual user characteristics should be targeted for addressing each of the identified engagement factors. In Figure 2, the result of this integration is represented after reorganizing the engagement factors based on the order of their importance with the following logic: (a) the expectations (i.e., primary engagement factors) precede the additional desires (i.e., secondary engagement factors), as they were the least of the users' demands that should be met, and (b) a lower number (starting from 1) represents more importance in each user expectation and additional desire, as they were labeled in order of most occurrence and urgency. The breakdown of our findings and practical implications for each of the primary and secondary engagement factors are detailed in Table 1–2, along with our recommended approach for addressing each factor.

Figure 2. Integrative diagram to inform the user experience of universal school-based DMHIs. *Note:* The color scheme of each primary factor (PF#) and each secondary factor (SF#) corresponds to the color scheme representing the four fundamental user needs.



3.4 Discussion

3.4.1 Overview of Key Findings

Through user needs research and conducting qualitative interviews with adolescents who had either a higher-than-average or a lower-than-average engagement with universal DMHI programs of a specific school-based digital mental health solution, also adolescents who had voluntarily used non-digital or non-school-based digital mental health resources for purposes other than treatment, the most important (or primary) and the additionally desirable (or secondary) factors that could lead the adolescents to better engage with

school-based DMHI programs were identified. The primary factors (labeled PF1–7) related to digital solutions' user experience that directly influence users' engagement with school-based DMHIs were identified as the following, in order of their importance and priority: (PF1) having psychological safety with using the digital mental health solution; (PF2) being able to use DMHI programs with a flexible approach; (PF3) understanding the scope and limitation of DMHI programs; (PF4) having access to a platform to exchange experiences with peers; (PF5) being able to access professional mental health support services, when the needed arises; (PF6) being able to translate and anchor practices and learning activities into the daily life; and, (PF7) being able to understand and assess the changes that could occur in one's mental well-being. Moreover, the secondary factors (labeled SF1–6) related to digital solutions' user experience that could facilitate a higher level of user engagement with school-based DMHIs were identified, in order of importance and priority, as the following: (SF1) having regular reinforcement of motivation; (SF2) having access to diverse in-depth learning opportunities; (SF3) practicing self-reflection and introspection through various reading, learning, questionnaires and other activities; (SF4) anticipating and planning for the upcoming programs and activities; (SF5) being able to choose activities based on one's personal preferences; and, (SF6) having access to valid, real-life reference points and success stories.

3.4.2 Theoretical Contributions

This study contributes to digital mental health, mental health intervention, and user experience literature through exploring the factors that will help explain why adolescent users would get more engaged with some universal school-based DMHI programs than with others, also how the experience of using a specific universal school-based DMHI program could become more engaging for adolescents. To our knowledge and at the time of initiation of this study, no recent qualitative exploratory research was conducted exclusively with adolescents of high school age while seeking to identify factors that influence their engagement with school-based DMHIs in non-treatment-focused settings (i.e., DMHIs not primarily used as a means for mental health treatment, counselling, or therapy for at-risk individuals or groups), whereas key works by O'Dea et al. (26), Aschbrenner et al. (27), Garrido et al. (28), Borghouts et al. (29–30), Auster-Gussman et al. (31), Cefai et al. (32), Yilmaz et al. (33), Wies et al. (34), Torous et al. (35), Babbage et al. (36), and Szinay et al. (37) have all paid attention to digital mental health in other important settings, for other user groups, or through other methodologies.

Recent and concurrent research efforts have been made that either (a) investigated acceptability of treatment-focused school-based DMHIs among high school students (by O'Dea et al. [26]), (b) explored the adolescents' use and preferences in treatment-focused digital mental health (by Aschbrenner et al. [27]), (c) explored the perspectives and preferences of young people including—but not focused on—adolescents regarding school-based digital mental health services through conducting a pilot study (by Garrido et al. [28]), (d) explored the experiences of young adults above high school age with non-school-based digital mental health applications (by Borghouts et al. [29]), (e) explored the barriers and facilitators of engagement with non-school-based DMHIs for adults above high school age (by Borghouts et al. [30] and Auster-Gussman et al. [31]), or (f) discussed

the potential benefits and risks of using digital mental health for adolescents (by Cefai et al. [32], Yilmaz et al. [33], Wies et al. [34]); although the mentioned studies have been very important and encouraging due to their focus in such sensitive topics and their goals in advancing the body of knowledge pertaining to DMHIs or digital mental health resources in general, none had particularly concentrated on non-treatment-focused digital interventions in high schools while exploring the perspective of their actual end-users or investigating user engagement factors with DMHIs.

Nevertheless, it is important that we acknowledge and compare our approach and results with few studies that were more relevant as they had a similar approach or similar exploratory goals to ours: (a) earlier, in 2018, Torous et al. (35) had theorized that poor usability, lack of user-centric design, privacy concerns, lack of trust as mental health information source, and lack of emergency measures were the five most responsible factors for low engagement with mental health apps. This theory came from a selective narrative review with the goal of finding themes among the reasons for low engagement with mental health smartphone apps and was primarily focused on the use of apps for personal or clinical treatment purposes and not included studies about school-based interventions. Our study, on the other hand, had a much more specific focus: It was focused solely on adolescent of high school age and on non-treatment-based DMHIs, also, it was specifically concerned with school-based DMHIs as its main target. Considering DMHIs in high schools introduce further variables and concerns into play due to their specific restrictions, their pre-defined target users and objectives, it is not surprising that none of Torous et al.'s five responsible factors were among the factors that were identified to be responsible for the lower-than-average engagement level of our participants, such as concerns about users' psychological safety, and the applicability and usefulness of the digital solution for the user, all of which are concerns particular to the age group and the context of school-based DMHIs; (b) also published in 2018, Babbage et al.'s qualitative study (36) which aimed to explore adolescents' desires from nonclinical digital tools for well-being self-management had some similarities in its data collection and analysis methods to ours (i.e., semi-structured interviews with adolescents of high-school age), but with one major difference: The participants had not used any digital solutions to manage their well-being prior to the interviews. Our study, on the other hand, was designed and envisioned to cover more grounds by including users who had extensive experiences (the frequent users), moderate experiences (the users of non-school-based digital resources), or limited experiences (the infrequent users) with nonclinical digital mental health tools, also nonusers, which unlike Babbage et al.'s nonuser participants had experiences with non-digital mental health resources with purposes similar to well-being self-management. Despite encompassing participants with different degrees of experience with digital mental health resources, some of our study's findings from the main participant groups (i.e., users with extensive or limited experiences) were found to have close similarities with Babbage et al.'s findings from their nonuser participants: Regarding how the adolescents expect to receive professional help in case of mental health emergencies, Babbage et al.'s *Theme 3.2* from *facet-based* themes (i.e., "providing information and direction for further support") matched our *Theme H3A*; and from Babbage et al.'s *feature-based* themes, *Theme 5* ("flexibility in choice and resources") and *Theme 6* ("enabling engagement with others") closely resembled our following findings, respectively: *Theme L1*, and both *Themes H2A* and *L3A*. These similarities between

findings from our main participant groups and Babbage et al.'s findings from their nonuser participants—which could also be found when comparing their results with our findings after combining both the main and supporting groups—suggest that our decision to include the supporting groups of participants was indeed helpful not only in providing us with more evidence and insights into adolescents' experiences with mental health resources, but also in increasing the credibility of the user engagement factors that we identified to be facilitators of adolescents' engagement with DMHIs; and (c) more recently and published in 2020, findings from Szinay et al.'s systematic review of digital behaviour change intervention studies which was focused on the uptake and engagement surrounding health and well-being smartphone apps had some similarities with our qualitative study (37). Although Szinay et al.'s review was concentrated on the adult population aged 18 and above, and only included studies with adolescents aged 16 and above if at least 70% of their participants were adults, the following identified factors influencing engagement were shared between our studies: The identified *knowledge* themes of "User guidance" and "Health information" from Szinay et al.'s study closely resembled factors discovered for our *Theme H3*, their *Environmental context and resources* theme of "Personalization to needs" resembled our *Theme L2*, and lastly, their *Social influences* themes of "Health practitioner support" and "Community networking" respectively matched *Theme H3A*, and both *Themes H2A* and *L3A*. This is while the "Social competition" theme found from Szinay et al.'s study directly contradicts our *Theme L1B:* Unsolicited comparisons and competitions were recognized by our adolescent participants as sources of immense psychological pressure. This contrast was however expected since the focus in our study was on the use of DMHIs in school settings and by adolescent users, who have life pressures, challenges, and mental barriers that, arguably, are vastly different from older age groups, therefore, in our study, having psychological safety—which contradicts the social competition theme identified in Szinay et al.'s study—was recognized as the users' main priority and the most important factor driving the adolescents' engagement with DMHIs (*PF1*).

3.4.3 Implications for Practice

To help inform the user experience design of digital mental health solutions for the developers and designers of school-based DMHIs, theoretical approaches (i.e., the TPC, and four fundamental human needs frameworks) were used that helped us investigate which capabilities, features and functionalities within digital mental health solutions should be focused on and provided so each of the identified engagement factors could be addressed. Our recommendations for addressing the engagement factors, as they are derived directly from analyzing our interviews' data can help increase the likelihood that the user experience of digital mental health solutions would meet the expectations and desires of adolescent students, and in doing so, would facilitate users' optimal level of engagement with universal school-based DMHI programs.

In the following Tables 1 and 2, the implications of each engagement factor and our recommended approach to address them are detailed.

Table 1. Implications of the identified primary engagement factors and our recommendations.

Note: Each factor presented in the table (PF#) represents a primary engagement factor described in Figures 1–2.

Factor	Underlying User Need	TPC Dimension	Implications of Our Findings and Our Recommended Approach
PF1	Comfort	Individual User	This expectation should be addressed by adapting and extending the programs and activities to become compatible with the users' motivations to use the digital solution, while respecting the following demands: (a) users expect to feel comfortable using the solution by doing so without feeling the pressure of commitment or obligation and thus feel invited and welcome to continue their progress whenever they would log back in; (b) users expect to be able to view their participation in the programs as a normal activity intended for everyone (as opposed to feel as if the programs are targeted for people who are not normal); and (c) users expect to have the choice to give permission for using their data for comparison purposes.
PF2	Comfort	Task	This expectation should be addressed via aspects related to physical and cognitive actions and processes that are required from the users when using the solution, while respecting the following demands: (a) users want to feel comfortable using the digital solution at their chosen times, environments and conditions (i.e., not being bound to follow the programs in specific time or place, such as a classroom), independently and by themselves without the presence of an instructor or a guide; and, (b) users want to be able to adapt the programs and activities to their schedule (especially considering the busy examination period) and their reality (via recommendations that could be applied to real life).
PF3	Comfort	Technology	This expectation should be addressed through aspects related to the solution's characteristics by removing ambiguities, as much as possible, surrounding what users can expect and what they cannot expect from using the solution, its programs and resources. The ambiguities would be minimized if the users are provided with (a) a guidance and support services (e.g., help and documentation) to get a clear understanding of how to use the solution, programs and resources while dispelling incorrect preconceived notions about them, and (b) to understand what benefits they can expect from the programs and when can they expect to see them after following the recommended steps for their completion.
PF4	Connection	Technology	This expectation should be addressed via aspects related to the technology characteristics by providing a discussion platform where the users: (a) feel safe and supported to connect with their peers and follow their discussions, and (b) feel empowered and encouraged to share their personal experiences and difficulties with others.
PF5	Comfort	Technology	This expectation should be addressed via aspects related to the technology characteristics, by providing easily accessible mental health support services to the users. The users should be provided with a simple, hassle-free way to contact an external support team or professional if personal or program-specific problems arise during or outside the time and place where they would use the solution; therefore, the support personnel should also be able to answer questions about the program(s) and activities and to guide the students in completing them.
PF6	Uniqueness	Individual User	This expectation should be addressed through adapting and extending the programs and activities to become compatible with the users' motivations to perform mental health-related tasks, by respecting the following demands: (a) users expect to be able to integrate mental health-related activities and techniques into their daily routines (i.e., perform activities in a place they already go, during the availabilities and with the accesses they already have), and (b) users expect their learnings (concepts, techniques and methods, etc.) can be implemented and put in practice in their day to day lives.
PF7	Uniqueness	Individual User	This expectation should be addressed through adapting and extending the programs and activities to become compatible with the users' motivations to use the solution, by empowering the users to: (a) understand the changes that can occur in their mental and physical health (due to stress, anxiety, depression, etc.), their causes, and how to alter or prevent them; (b) understand what they can change (either by themselves or receiving professional help) and what cannot be controlled; and (c) track progress and changes that have occurred in their mental health since the start of their participation in the program.

Table 2. Implications of the identified secondary engagement factors and our recommendations.

Note: Each factor presented in the table (SF#) represents a secondary engagement factor described in Figures 1–2.

Factor	Underlying User Need	TPC Dimension	Implications of Our Findings and Our Recommended Approach
SF1	Variety	Individual User	This additional desire could be addressed through adapting and extending the programs, activities, learning and supplementary materials to become compatible with the users' motivations for performing mental health-related tasks, by empowering the users to: (a) cultivate internal sources of motivation and avoid external motivations focused on competition; (b) regularly benefit from the supporting learning activities and practices, (c) understand how the intangible benefits of partaking in the program's activities can be felt, and (d) feel their past efforts are accounted for and would be pursued further.
SF2	Uniqueness	Technology	This additional desire could be addressed via aspects related to the technology characteristics, by providing learning opportunities that: (a) are presented and repeated through different methods (integrated within videos, readings, etc.), (b) deliver or instruct on how to acquire in-depth education on mental health topics, (c) can evolve and advance over time (with the user's or the semester's progress), and (d) offer easy-to-understand lessons and readings on relevant sensitive subjects (such as bullying, addiction, or racism).
SF3	Uniqueness	Individual User	This additional desire could be addressed through adapting and extending the programs' materials to become compatible with the users' motivation for learning about themselves and the aspects unique to themselves via questionnaires and quizzes, learning activities and practices that encourage self-reflection and introspection.
SF4	Uniqueness	Technology	This additional desire could be addressed via aspects related to the technology characteristics, by providing timely and clear communications surrounding the upcoming activities and programs, also the required effort to achieve the desired outcome from the learnings and practices so that the interested users can accommodate their plans for them.
SF5	Variety	Individual User	This additional desire could be addressed through adapting and extending the programs, activities, learning and supplementary materials to become compatible with the users' personal characteristics and preferences such as through providing adjustable settings for difficulty, usage frequency, and concentration levels required for completing any program.
SF6	Connection	Technology	This additional desire could be addressed through technology characteristics, by providing: (a) a dedicated forum where the users can understand how other peers are experiencing the same program, (b) inspiring success stories and anecdotes with which users can learn about experiences of others who overcame the difficulties that were similar to themselves, (b), and (c) access to qualified peers who could act as users' mentor or guide for the program.

3.4.4 Limitations and Research Avenues

The results of our study must be seen in light of the limitations that it was subjected to, especially due to the sensitive nature of studies on the topic of mental health, particularly with adolescents: (a) since our recruitment and data collection processes started during the busiest period of the schoolyear (i.e., few weeks before the final examination period), which other than causing a variety of concerns for students might have also prevented them from checking their emails as frequently or as attentively as before, the research team was unable to recruit more participants for each group and to have more representative groups of participants, especially for the main participant groups: Out of a total of 33 users that were identified meeting the criteria of *frequent users*, only five (15.1%) were male students, therefore, it was not surprising that no male frequent users responded to the invitations for participating in our interviews during this period and that all the four participants self-identified as female for this group; in addition, although there were 33 users identified as potential participants in *infrequent users* group, only four responded to the invitations (and after two rounds of sending the invitations), out of which none were male students, even though they represented 27.3% (nine out of 33) of the sample. To address sampling limitations of this research, qualitative research opportunities could be pursued in the future with similar focus, goals, and exploratory approach centered on identifying the factors that could influence user engagement with school-based DMHIs, but with more participants, with more representative individuals, especially by recruiting a selection of individuals with more variance in their gender identities and their age-groups (specifically since our research was limited to adolescents aged 14 and above), and on a period in the calendar and schoolyear that would be respectful to the adolescents' schedules (i.e., not close to holiday or examinations' period, both of which could introduce unforeseeable complications in participants' schedules and willingness for participation); (b) apart from the busy schedules that students had near the end of their schoolyear, since our participants were mostly contacted through their schools' email address or schools' newsletters (apart from the participants that were recruited through social media platforms), there were concerns that the contacted students—especially the ones who met the criteria for infrequent users—might believe they were being questioned for their lack of participation in the programs and might thus decide against participating in our study or inquiring further about it. Although the research team aimed to proactively address any such concerns through promoting this study—through invitation letters and consent forms, also at the beginning of interviews—as completely independent from both the schools and the mental health resources to be discussed, and our findings from the interviews strongly indicated this approach was successful as the participants held no reservations to discuss their honest opinions, preferences, and felt experiences with the digital mental health resources in question, it can neither be ascertained whether having a certain level of trust between the participants and their high schools or the professionals responsible for digital mental health resources had initially influenced the students' participation, nor can it be objectively investigated or measured whether the level of this trust might have affected users' engagement with digital mental health resources. Therefore, an exciting but also very important research opportunity that we propose is to focus on how the level of trust between the students and their high schools or their relevant staff affects students' engagement levels with universal

school-based DMHIs; and (c) last but not least, even though many parallels were found between the results of our research and the findings from a systematic review that aggregated the data from studies with similarities to ours (37), since a purposive sampling was used in this study to limit major contextual differences—which could introduce uncontrollable variables in this type of qualitative research—in perceptions, opinions, and experiences of the adolescent participants, it cannot be established that replicating the methodology of our study in other contextual settings would result in finding the same engagement factors identified in our study. Therefore, promising avenues for future research reside in constructing series of qualitative research efforts with the goal of identifying user engagement factors with school-based DMHIs through replicating or encompassing the groups that were targeted in this study (i.e., having different degrees of experience with non-treatment-focused digital mental health), each set in a different social, cultural, and physical environment—as these factors could shape differences in adolescents' perceptions, opinions and experiences (15)— to determine the engagement factors that are shared between all adolescents irrespective of their contextual differences.

3.4.5 Conclusion

Through an exploratory research on a topic that required urgent attention, this study sought to extend the body of knowledge pertaining to user engagement through uncovering the needs of adolescents—either with or without prior experiences with digital mental health resources—that are targeted for nonclinical school-based DMHIs. Moreover, seeking to contribute to practice by helping inform the user experience of digital interventions through ensuring the expectations and desires of their targeted users could be met, this study has put forward specific recommendations to address each identified engagement factor by depending solely on findings from the interviews that were conducted with the actual end-users of school-based DMHIs. It is hoped that our findings and recommendations can help increase the likelihood of effectiveness of universal school-based DMHI programs for high school students, also could be used as a means for the designers and developers in the user experience and human-computer interaction fields to help them put a more focused effort in addressing the user needs and creating a more engaging experience for their users. Furthermore, it is hoped that this effort could raise more attention towards the topic, in both academia and practice, also could inspire academic researchers for further research and future continuation and verification of findings of this study.

Funding Statement

This research was made possible through the grant awarded by Québec government's *Ministère de l'Économie et de l'Innovation* (MEI) for supporting research efforts on *Innovation sociale en IA*.

Acknowledgements

We would like to express our gratitude to professional team members who provided their support and mentorship concerning specific subject areas in our study: Sylvie Lachize in user needs research and design thinking methodology, and Geneviève D'Arcy and Roxanne Lajoie in mental health and DMHI. We would also like to extend our special thanks to volunteer students from our institution (graduate students Danya Swoboda and Arriele Hakim, and undergraduate students Lola Grumbach and Rayan Abad) who aided in the bilingual data collection and preliminary analysis stages of the research project.

Abbreviations

AD: Additional user desires from digital mental health solutions.
DMHI: Digital mental health intervention.
PF: Primary engagement factor with universal school-based DMHI programs.
REB: Our institution's Research Ethics Board.
SF: Secondary engagement factor with universal school-based DMHI programs.
TPC: Technology-to-Performance Chain model.
UE: User expectations from digital mental health solutions.

Conflicts of Interest

Authors declare that apart from the collaboration with a local non-profit organization, the research was conducted in the absence of other commercial or financial relationships that could be construed as a potential conflict of interest.

Data Availability Statement

The datasets presented in this article are not readily available because there are legal reasons involved due to the collaboration with a third-party organization in partnership with HEC Montréal. Requests to access the datasets should be directed to ss@hec.ca.

Author Contributions

All authors initiated the research project. EB performed literature review for the study. EB and CKC identified conceptual frameworks that were relevant and applicable to the study. EB planned for recruitment and data collection while CKC, SS, and PML assessed study eligibility and quality. SS and CKC planned the qualitative analysis. EB conducted the interviews, extracted and analyzed the collected data, with assistance from bilingual volunteer students from the university. EB wrote the first draft of the manuscript with guidance from SS and PML. All authors contributed to the interpretation and subsequent edits of the manuscript.

Supplementary Material

Supplementary Table A. Characteristics of the interview participants.

Participant	Gender	Participant Group	Grade Level	Age Group	School Type
P1	F	Frequent User	Grade 10	15–16	Public
P2	F	Frequent User	Grade 10	15–16	Public
P3	F	Frequent User	Grade 10	15–16	Private
P4	F	Frequent User	Grade 9	14–15	Private
P5	F	Infrequent User	Grade 9	14–15	Private
P6	F	Infrequent User	Grade 9	14–15	Private
P7	F	Infrequent User	Grade 9	14–15	Private
P8	F	Infrequent User	Grade 10	15–16	Private
P9	F	Non-Digital	Grade 9	14–15	Private
P10	F	Digital	Grade 9	14–15	Private
P11	M	Digital	Grade 10	15–16	Public
P12	M	Both Non-Digital & Digital	Grade 10	15–16	Public
P13	F	Both Non-Digital & Digital	Grade 9	14–15	Private
P14	F	Both Non-Digital & Digital	Grade 9	14–15	Private
P15	F	Both Non-Digital & Digital	Grade 9	14–15	Public
P16	F	Non-Digital	Grade 9	14–15	Public

References

1. Impacts on mental health. Government of Canada (2020) Statistics Canada https://www150.statcan.gc.ca/n1/pub/11-631-x/2020004/s3-eng.htm [Accessed February 10, 2022]
2. Stress in America™ 2020: A National Mental Health Crisis (2020) Am Psychol https://www.apa.org/news/press/releases/stress/2020/sia-mental-health-crisis.pdf [Accessed February 10, 2022]
3. Canadian Health Survey on Children and Youth, 2019 (2020) Government of Canada, Statistics Canada. https://www150.statcan.gc.ca/n1/daily-quotidien/200723/dq200723a-eng.htm [Accessed February 10, 2022]
4. America's mental health 2018 (2018) Cohen Veterans Network p. 11. https://www.cohenveteransnetwork.org/wp-content/uploads/2018/10/Research-Summary-10-10-2018.pdf [Accessed June 11, 2022]
5. Radez J, Reardon T, Creswell C, Lawrence PJ, Evdoka-Burton G, Waite P (2020) Why do children and adolescents (not) seek and access professional help for their mental health problems? A systematic review of Quantitative and Qualitative Studies. Eur Child Adolesc Psychiatry 30:183–211. doi:10.1007/s00787-019-01469-4
6. Anglin TM (2003) Mental health in schools. Handbook of School Mental Health: Advancing Practice and Research p. 89–106. doi:10.1007/978-0-387-73313-5_7
7. Masia-Warner C, Nangle DW, Hansen DJ (2006) Bringing evidence-based child mental health services to the schools: General issues and specific populations. Faculty Publications, Department of Psychology p. 71. https://digitalcommons.unl.edu/psychfacpub/71 [Accessed June 15, 2021]
8. Stallard P, Skryabina E, Taylor G, Phillips R, Daniels H, Anderson R, Simpson N (2014) Classroom-based cognitive behaviour therapy (friends): A cluster randomised controlled trial to prevent anxiety in children through education in schools (paces). Lancet Psychiatry 1:185–192. doi:10.1016/s2215-0366(14)70244-5
9. Neil AL, Christensen H (2009) Efficacy and effectiveness of school-based prevention and early intervention programs for anxiety. Clin Psychol Rev 29:208–215. doi: 10.1016/j.cpr.2009.01.002
10. Barrett PM, Lock S, Farrell LJ (2005) Developmental differences in Universal Preventive Intervention for Child Anxiety. Clin Child Psychol Psychiatry 10:539–555. doi:10.1177/1359104505056317
11. Fisak BJ, Richard D, Mann A (2011) The prevention of child and adolescent anxiety: A meta-analytic review. Prev Sci 12:255–268. doi:10.1007/s11121-011-0210-0
12. Ahlen J, Lenhard F, Ghaderi A (2015) Universal prevention for anxiety and depressive symptoms in children: A meta-analysis of randomized and cluster-randomized trials. J Prim Prev 36(6):387–403. doi:10.1007/s10935-015-0405-4
13. Tedder M, Shi L, Si M, Franco R, Chen L (2015) eMindfulness therapy—a study on efficacy of blood pressure and stress control using mindful meditation and eating apps among people with high blood pressure. Medicines 2:298–309. doi:10.3390/medicines2040298

14. Merry SN, Moor S (2015) “School-based mental health interventions,” in Rutter's child and adolescent psychiatry, eds. A. Thapar, D. S. Pine. Wiley-Blackwell p. 545–558

15. Perski O, Blandford A, West R, Michie S (2016) Conceptualising engagement with Digital Behaviour Change Interventions: A systematic review using principles from Critical Interpretive Synthesis. Transl Behav Med 7:254–267. doi:10.1007/s13142-016-0453-1

16. Saleem M, Kühne L, De Santis KK, Christianson L, Brand T, Busse H (2021) Understanding engagement strategies in digital interventions for Mental Health Promotion: Scoping Review (preprint). JMIR Ment Health doi:10.2196/preprints.30000

17. Gan DZQ, McGillivray L, Han J, Christensen H, Torok M (2021) Effect of engagement with digital interventions on Mental Health Outcomes: A systematic review and meta-analysis. Front Digit Health 3: doi:10.3389/fdgth.2021.764079

18. Clarke AM, Kuosmanen T, Barry MM (2014) A systematic review of Online Youth Mental Health Promotion and prevention interventions. J Youth Adolesc 44:90–113. doi:10.1007/s10964-014-0165-0

19. Gill P, Stewart K, Treasure E, Chadwick B (2008) Methods of data collection in qualitative research: Interviews and focus groups. British Dental Journal 204:291–295. doi:10.1038/bdj.2008.192

20. Ulrich KT, Eppinger SD (2016) “Identifying Customer Needs,” in Product design and development. The McGraw-Hill Companies, Inc. p. 73–90

21. Gibbons S (2019) User need statements: The ‘Define’ Stage in Design Thinking. Nielsen Norman Group. https://www.nngroup.com/articles/user-need-statements/ [Accessed June 27, 2022]

22. International Organization for Standardization (2019) ISO 9241-210:2019(en), 3.15 _ Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems_. Geneva: ISO

23. McQuivey J (2013) “Digital Consumers Want to Fulfill Their Needs,” in Digital Disruption: Unleashing the next wave of innovation. Forrester Research, Inc. p. 54–68

24. Goodhue DL, Thompson RL (1995) Task-technology fit and individual performance. MIS Quarterly 19:213. doi:10.2307/249689

25. Spies R, Grobbelaar S, Botha A (2020) A scoping review of the application of the task-technology fit theory. Lecture Notes in Computer Science 397–408. doi:10.1007/978-3-030-44999-5_33

26. O’Dea B, King C, Subotic-Kerry M, Achilles MR, Cockayne N and Christensen H (2019) Smooth Sailing: A Pilot Study of an Online, School-Based, Mental Health Service for Depression and Anxiety. Front. Psychiatry 10:574. doi: 10.3389/fpsyt.2019.00574

27. Aschbrenner KA, Naslund JA, Tomlinson EF, Kinney A, Pratt SI and Brunette MF (2019) Adolescents' Use of Digital Technologies and Preferences for Mobile Health Coaching in Public Mental Health Settings. Front. Public Health 7:178. doi: 10.3389/fpubh.2019.00178

28. Garrido S, Millington C, Cheers D, Boydell K, Schubert E, Meade T and Nguyen QV (2019) What Works and What Doesn't Work? A Systematic Review of Digital Mental Health Interventions for Depression and Anxiety in Young People. Front. Psychiatry 10:759. doi: 10.3389/fpsyt.2019.00759

29. Borghouts J, Eikey EV, Mark G, De Leon C, Schueller SM, Schneider M, Stadnick N, Zheng K, Mukamel DB, Sorkin DH (2021) Understanding Mental Health app use among community college students: Web-based survey study. J Med Internet Res 23: doi:10.2196/27745

30. Borghouts J, Eikey E, Mark G, De Leon C, Schueller SM, Schneider M, Stadnick N, Zheng K, Mukamel D, Sorkin DH (2021) Barriers to and facilitators of user engagement with Digital Mental Health Interventions: Systematic Review. J Med Internet Res 23: doi:10.2196/24387

31. Auster-Gussman LA, Lockwood KG, Graham SA, Pitter V and Branch OH (2022) Engagement in Digital Health App-Based Prevention Programs Is Associated with Weight Loss Among Adults Age 65+. Front. Digit. Health 4:886783. doi: 10.3389/fdgth.2022.886783

32. Cefai C, Camilleri L, Bartolo P, Grazzani I, Cavioni V, Conte E, Ornaghi V, Agliati A, Gandellini S, Tatalovic Vorkapic S, Poulou M, Martinsone B, Stokenberga I, Simões C, Santos M and Colomeischi AA (2022) The effectiveness of a school-based, universal mental health programme in six European countries. Front. Psychol 13:925614. doi: 10.3389/fpsyg.2022.925614

33. Yilmaz SK and Bohara AK (2021) mHealth: Potentials and Risks for Addressing Mental Health and Well-Being Issues Among Nepali Adolescents. Front. Public Health 9:563515. doi: 10.3389/fpubh.2021.563515

34. Wies B, Landers C and Ienca M (2021) Digital Mental Health for Young People: A Scoping Review of Ethical Promises and Challenges. Front. Digit. Health 3:697072. doi: 10.3389/fdgth.2021.697072

35. Torous J, Nicholas J, Larsen ME, Firth J, Christensen H (2018) Clinical Review of user engagement with mental health smartphone apps: Evidence, theory and improvements. Evid Based Ment Health 21:116–119. doi:10.1136/eb-2018-102891

36. Babbage C, Jackson GM, Nixon E (2018) Desired features of a digital technology tool for self-management of well-being in a nonclinical sample of young people: Qualitative study. JMIR Ment Health 5: doi:10.2196/10067

37. Szinay D, Jones A, Chadborn T, Brown J, Naughton F (2020) Influences on the uptake of and engagement with health and well-being smartphone apps: Systematic review. J Med Internet Res 22: doi:10.2196/17572

Chapter 4: Discussion

4.1 Review of Research Context and Goals

Recent studies and reports (APA, 2020; Statistics Canada, 2020a) strongly emphasize that adolescent students are in critical mental health conditions and require urgent attention, especially as their uncertainties and life stresses are reportedly increased since the start of COVID-19 pandemic (Statistics Canada, 2020b). However, research shows that not only there is still a significant lack of access to both mental health education and resources for adolescents (Cohen Veterans Network, 2018), but also the stigma associated with seeking help for mental health at this young age has been reported as 'paralyzing' for these vulnerable members of society (Radez et al., 2021). Since high schools are the locations at which the majority of adolescents spend their time and can thus be reached (Anglin, 2003), there has been a renewed interest in providing mental health education and resources to adolescent students, especially since these could be done in the least stigmatic and most accessible settings: through a universal delivery of digital mental health intervention (DMHI) programs (Fisak et al., 2011; Merry & Moor, 2015). With DMHI programs, high schools can offer a cost-free, accessible, flexible and affordable tool for educating, empowering, and supporting their adolescent students in improving and maintaining their mental health (Tedder et al., 2015). However, the main questions that high schools are facing now is that how they could maximize the likelihood that their students could receive the intended benefits of digital interventions. Research has shown that for DMHI programs to be effective in having their intended positive mental health outcomes for their users, user engagement has been a crucial signifier (Gan et al., 2021; Saleem et al., 2021). This thesis has focused on understanding adolescent students' experiences, opinions and preferences surrounding digital mental health resources (or e-mental health) in order to identify the most important factors that facilitate the users' engagement with universal school-based DMHI programs, and in return, increase the likelihood that students could receive the intended benefits of digital interventions that their schools would offer.

With these goals, our research team which consists of three prominent academic scholars, an industry professional in digital mental health, an experienced mental health professional and five dedicated researchers conducted a total of 16 exploratory interviews with semi-structured questions focused on uncovering the expectations and desires of adolescents resulting from their past or from

anticipating possible future experiences with DMHI programs[7]. We used the framework for user engagement that Perski et al. (2016) had developed in which through their systematic review of user engagement with digital interventions, they conceptualized engagement as a construct relying both on the usage behavior and the subjective experience of the users. Using this relevant framework allowed us to focus our data collection and our recruitment efforts, and particularly, the framework guided us in planning for limiting major discrepancies in the contexts of use and other social and environmental settings that could introduce contextual differences in the users' perceived experiences and opinions. Two sets of interviews were conducted by the research team: (a) the main set: a total of eight users of a specific web-based digital mental health solution who had either a higher-than-average (n=4) or a lower-than-average (n=4) engagement with solution's DMHI programs; focusing on the users of one particular solution helped us investigate—without being concerned with differences in opinions and subjective experiences influenced by noticeably different contextual, environmental or societal settings—the reasons that could lead the users to better engage with a specific school-based DMHI programs, as well as the shortcomings that could prevent that from happening; and (b) the supporting set: the perspectives of eight adolescents who were current or past students at high schools in Quebec and who had followed non-digital mental health resources such as yoga, meditation and mindfulness classes (n=6) or had used non-school-based digital mental health solutions (n=6), all for purposes other than clinical treatment or counselling were explored, while some students answered questions pertaining to both digital and non-digital resources. By integrating the collected data from both sets of interviews and performing a thematic analysis using user needs research methodology, the most important user expectations (or *primary factors*) and additional desires (or *secondary factors*) that could facilitate engagement with school-based DMHI programs were identified. Subsequently, through further revisiting and investigating the collected data, specific recommendations were proposed to help high schools, also HCI and UX practitioners in targeting each of the discovered engagement factors to ensure the likelihood of continued utilization and engagement with school-based DMHI programs could be increased, which in effect, could increase the likelihood that their mental health interventions would be beneficial for adolescent users.

[7] Refer to Appendix 1 for a summary of interview procedures and guides.

4.2 Summary of Key Findings

To focus our exploratory efforts toward reaching the specified research goals, our team defined and sought finding answers to specific research questions (RQ), both of which are shared in the following table.

Table 1

Summary of Research Questions and Findings

#	Question	Answer
RQ1	What are the main underlying factors that drive adolescent students' expectations and desires from universal school-based digital mental health solutions?	• Comfort (C): The need to remove ambiguity, complexity, and sources of stress associated when using the digital solution • Connection (Co): The need to belong with others and to feel welcomed and supported with using the solution • Variety (V): The need to feel excited about possibilities and to anticipate new experiences and diversions from monotony by using the solution • Uniqueness (U): The need to feel special, capable, and optimistic about opportunities for improvement by using the solution
RQ2	What are the factors related to user experience of digital mental health solutions that drive the engagement of frequent adolescent users with DMHI programs?	1. To be able to adapt the programs to their schedules and reality 2. To receive incentives for participation 3. To have access to comprehensive information 4. To practice self-reflection & introspection with various activities
RQ3	The absence of which factors related to user experience of digital mental health solutions lead to a lack of engagement with DMHI programs for infrequent adolescent users?	1. To have psychological safety when using the digital solution 2. To have access to individualized contents and activities 3. To receive incentives for participation
RQ4	<u>The main research question of the thesis:</u> What factors related to user experience of digital mental health solutions facilitate adolescent students' engagement with universal school-based digital mental health intervention programs?	*Primary Factors (User Expectations):* 1. To have psychological safety with using the mental health solution 2. To be able to have a flexible approach with using DMHI programs 3. To understand the scope and limitations of specific DMHI programs 4. To have access to a platform to exchange experiences with peers 5. To be able to access professional mental health support services 6. To be able to translate practices and learnings to daily life 7. To understand and assess the changes that occur in mental well-being *Secondary Factors (Additional Desires):* 1. To have regular reinforcement of motivation 2. To have access to diverse in-depth learning opportunities 3. To practice self-reflection & introspection with various activities 4. To anticipate and plan for the upcoming activities and programs 5. To be able to choose activities based on personal preferences 6. To have access to a valid, real-life reference point or success story

4.3 Contributions to Theory

This thesis contributes to digital mental health, mental health intervention, and user experience literature through exploring the factors that will help explain why adolescent users get more engaged with some universal school-based DMHI programs than with others, also how the user experience of specific universal school-based DMHI programs could become more engaging for adolescents. To our knowledge and at the time of initiation of this research project, no recent qualitative exploratory study, especially in North America, was conducted exclusively with high school students while seeking to explore their experiences, uncover their needs, and identify the factors that influence their engagement with school-based DMHIs in nonclinical settings, whereas key prior or concurrent efforts by Aschbrenner et al. (2019), Auster-Gussman et al. (2022), Borghouts et al. (2021a; 2021b), Cefai et al. (2022), Garrido et al. (2019), O'Dea et al. (2019), Torous et al. (2018), Wies et al. (2021), and Yilmaz et al. (2021) have all paid attention to digital mental health in other important settings, with other methodologies or with other target users in mind.

However, it is important to recognize two recent efforts that were more relevant to our study than the mentioned key works, especially due to similarities in their approach or in their exploratory goals to ours: (a) a qualitative study that was conducted with similar focus to ours was Babbage et al.'s research (2018), which aimed to explore adolescents' desires from nonclinical digital tools for well-being self-management. Although our studies both used a similar exploratory approach as we both conducted semi-structured interviews with adolescents of high-school age, Babbage et al.'s participants had not used any digital solutions to manage their well-being prior to their interviews. Our study, on the other hand, was designed and envisioned to cover more grounds as it included the actual end-users who either had extensive experiences (the frequent users), moderate experiences (the users of non-school-based digital resources), or limited experiences (the infrequent users) with nonclinical digital mental health resources, also included potential adolescent users who had prior experiences in using non-digital mental health resources (such as school-based and non-school-based meditation, yoga, or mindfulness classes) with purposes similar to well-being self-management. Despite encompassing participants with different degrees of experience with digital mental health resources, some of our study's findings from the main participant groups (i.e., users with extensive or limited experiences with school-based digital mental health solutions) were found to have close similarities with Babbage et al.'s findings from their nonuser participants. These similarities, which were also found when comparing Babbage et al.'s

findings with the aggregated results from our main and supporting participant groups suggest that our decision to include the supporting sets of participants had indeed provided us with more credible evidence and insights into the factors that could influence the engagement of adolescents with DMHIs; and more recently, (b) findings from Szinay et al.'s systematic review of digital behaviour change intervention studies (2020), which was focused on the uptake and engagement surrounding health and well-being smartphone apps had considerable similarities with the findings of our study. Although Szinay et al.'s review was concentrated on the adult population aged 18 and above, and only included studies with adolescents aged 16 and above if at least 70% of their participants were adults, many factors that identified to be influencing user engagement were shared between our studies, except one factor that was contradictory: "Social competition". This contrast was however expected since in our study, specifically for the main participant groups, our focus was on the use of DMHIs in school settings, and by the adolescent users who arguably have vast differences in their life pressures, challenges, and mental barriers compared to older age groups and thus having psychological safety (the first primary factor of user engagement based on both main and supporting sets of interviews with adolescents), was recognized in our study as adolescents' priority, the main driving factor for their engagement with DMHIs.

4.4 Implications for Practice

To help inform the user experience design of digital mental health solutions for the developers and designers of school-based DMHIs, our team investigated which capabilities, features and functionalities within digital mental health solutions should be focused on and provided so each of the identified engagement factors could be addressed. Our recommendations for addressing the engagement factors, as they are derived directly from analyzing our interviews' data can help increase the likelihood that the user experience of digital mental health solutions would meet the expectations and desires of adolescent students, and in doing so, would influence a higher level of user engagement with universal school-based DMHI programs.

In the following tables, the practical implications of each engagement factor and our recommended approach to address them are discussed.

Table 2

Discussion of Practical Implications of Primary Engagement Factors

Factor	Underlying User Need	Target Dimension	Implications of Our Findings and Our Recommended Approach
1	Comfort	Individual User	This expectation should be addressed by adapting and extending the programs and activities to become compatible with the users' motivations to use the digital solution, while respecting the following demands: (a) users expect to feel comfortable using the solution by doing so without feeling the pressure of commitment or obligation and thus feel invited and welcome to continue their progress whenever they would log back in; (b) users expect to be able to view their participation in the programs as a normal activity intended for everyone (as opposed to feel as if the programs are targeted for people who are not normal); and (c) users expect to have the choice to give permission for using their data for comparison purposes.
2	Comfort	Task	This expectation should be addressed via aspects related to physical and cognitive actions and processes that are required from the users when using the solution, while respecting the following demands: (a) users want to feel comfortable using the digital solution at their chosen times, environments and conditions (i.e., not being bound to follow the programs in specific time or place, such as a classroom), independently and by themselves without the presence of an instructor or a guide; and, (b) users want to be able to adapt the programs and activities to their schedule (especially considering the busy examination period) and their reality (via recommendations that could be applied to real life).
3	Comfort	Technology	This expectation should be addressed through aspects related to the solution's characteristics by removing ambiguities, as much as possible, surrounding what users can expect and what they cannot expect from using the solution, its programs and resources. The ambiguities would be minimized if the users are provided with (a) a guidance and support services (e.g., help and documentation) to get a clear understanding of how to use the solution, programs and resources while dispelling incorrect preconceived notions about them, and (b) to understand what benefits they can expect from the programs and when can they expect to see them after following the recommended steps for their completion.
4	Connection	Technology	This expectation should be addressed via aspects related to the technology characteristics by providing a discussion platform where the users: (a) feel safe and supported to connect with their peers and follow their discussions, and (b) feel empowered and encouraged to share their personal experiences and difficulties with others.
5	Comfort	Technology	This expectation should be addressed via aspects related to the technology characteristics, by providing easily accessible mental health support services to the users. The users should be provided with a simple, hassle-free way to contact an external support team or professional if personal or program-specific problems arise during or outside the time and place where they would use the solution; therefore, the support personnel should also be able to answer questions about the program(s) and activities and to guide the students in completing them.
6	Uniqueness	Individual User	This expectation should be addressed through adapting and extending the programs and activities to become compatible with the users' motivations to perform mental health-related tasks, by respecting the following demands: (a) users expect to be able to integrate mental health-related activities and techniques into their daily routines (i.e., perform activities in a place they already go, during the availabilities and with the accesses they already have), and (b) users expect their learnings (concepts, techniques and methods, etc.) can be implemented and put in practice in their day to day lives.
7	Uniqueness	Individual User	This expectation should be addressed through adapting and extending the programs and activities to become compatible with the users' motivations to use the solution, by empowering the users to: (a) understand the changes that can occur in their mental and physical health (due to stress, anxiety, depression, etc.), their causes, and how to alter or prevent them; (b) understand what they can change (either by themselves or receiving professional help) and what cannot be controlled; and (c) track progress and changes that have occurred in their mental health since the start of their participation in the program.

Note. The primary engagement factors are completely listed as part of the answers to RQ4 in Table 1.

Table 3

Discussion of Practical Implications of Secondary Engagement Factors

Factor	Underlying User Need	Target Dimension	Implications of Our Findings and Our Recommended Approach
1	Variety	Individual User	This additional desire could be addressed through adapting and extending the programs, activities, learning and supplementary materials to become compatible with the users' motivations for performing mental health-related tasks, by empowering the users to: (a) cultivate internal sources of motivation and avoid external motivations focused on competition; (b) regularly benefit from the supporting learning activities and practices, (c) understand how the intangible benefits of partaking in the program's activities can be felt, and (d) feel their past efforts are accounted for and would be pursued further.
2	Uniqueness	Technology	This additional desire could be addressed via aspects related to the technology characteristics, by providing learning opportunities that: (a) are presented and repeated through different methods (integrated within videos, readings, etc.), (b) deliver or instruct on how to acquire in-depth education on mental health topics, (c) can evolve and advance over time (with the user's or the semester's progress), and (d) offer easy-to-understand lessons and readings on relevant sensitive subjects (such as bullying, addiction, or racism).
3	Uniqueness	Individual User	This additional desire could be addressed through adapting and extending the programs' materials to become compatible with the users' motivation for learning about themselves and the aspects unique to themselves via questionnaires and quizzes, learning activities and practices that encourage self-reflection and introspection.
4	Uniqueness	Technology	This additional desire could be addressed via aspects related to the technology characteristics, by providing timely and clear communications surrounding the upcoming activities and programs, also the required effort to achieve the desired outcome from the learnings and practices so that the interested users can accommodate their plans for them.
5	Variety	Individual User	This additional desire could be addressed through adapting and extending the programs, activities, learning and supplementary materials to become compatible with the users' personal characteristics and preferences such as through providing adjustable settings for difficulty, usage frequency, and concentration levels required for completing any program.
6	Connection	Technology	This additional desire could be addressed through technology characteristics, by providing: (a) a dedicated forum where the users can understand how other peers are experiencing the same program, (b) inspiring success stories and anecdotes with which users can learn about experiences of others who overcame the difficulties that were similar to themselves, (b), and (c) access to qualified peers who could act as users' mentor or guide for the program.

Note. The secondary engagement factors are listed as part of the answers to RQ4 in Table 1.

4.5 Limitations and Future Research

The findings of this thesis must be seen in light of the limitations faced throughout the research project. Due to the sensitive nature of studies on the topic of mental health, particularly with adolescents, several ethical considerations and methodological accommodations were put in place to ensure this project could meet requirements of a rigorous and ethical research.

Since our recruitment processes commenced during the busiest period of the schoolyear, few weeks before the final examination period, we were not able to recruit more participants for each participant group or to have more representative groups of participants; particularly, for users of particular digital mental health solution, we had to limit our participants to only four users per each group as there were not enough respondents to the invitation letters, even after two rounds of sending them to all 33 potential participants per each group. To address these and similar sampling limitations in our study, similar research efforts (in terms of scope, goals, and general approach) focusing on identifying factors that influence user engagement with DMHIs could be reproduced with a similar or a more wider or narrower target groups, but with more participants, more representative individuals (especially by recruiting participants with more variance in their gender identities and ages or age-groups), and on a period in the calendar and schoolyear that would not fall in the holiday or examinations period (as they could introduce unforeseen or undetectable complications in participants' schedules or attitudes during the interviews).

Furthermore, since apart from the participants that were recruited through social media platforms organically (without a paid promotional campaign), our participants were contacted and recruited through their high schools (via their email addresses or their schools' newsletters), the research team was concerned that the contacted individuals—especially the ones who met the criteria for lower-than-average engagement with school-based DMHI programs—might wrongly assume they were being questioned for their lack of participation in the programs and would therefore decide against participating in or inquiring about our study. To proactively address any such concerns, the research team decided to (a) promote our study through invitation letters, consent forms, and explanations at the beginning of interviews as completely independent from both the schools and the mental health resources they were using in their schools or on their own; and (b) not include usage criteria for infrequent users inside their invitation letters and only ask them to

have a good recollection of their experience with DMHI programs or the platform itself. Although our discussions during the interviews were a strong indication that our approach was successful, as our participants held no reservations to share their honest opinions and felt experiences with the digital mental health resources in question, we cannot ascertain that having a certain level of trust between users and their high schools or their staff had no influences over the students' decision to participate and over their consequent discussions in our interviews. Therefore, an important research opportunity that this limitation arises would be to focus on how the level of trust between students and their high schools—or their staff responsible for digital mental health resources—influences students' engagement levels with universal school-based DMHIs.

Moreover, because a non-probability purposive sampling was used to limit contextual differences between the participants that would be recruited for our interviews, we cannot establish that replicating our methodology to conduct a similar study could result in finding engagement factors that are similar to ours, even though that there were many parallels found between the results of our research and the findings from a systematic review that was conducted by Szinay et al. (2020) in which they had aggregated data from many studies with similarities to ours. Therefore, an exciting avenue for future research that we propose is through conducting a series of qualitative studies focused on identifying user engagement factors with school-based DMHIs and by encompassing participant groups with different degrees of experience with non-treatment-focused digital mental health (similar to our research), but each study would be set in a different social, cultural, and physical environment—as these contextual factors could shape differences in perceptions, opinions and experiences for adolescents (Perski et al., 2016)—in order to ascertain which engagement factors are shared between all adolescents, regardless of their contextual differences.

4.6 Conclusion

This thesis offers insights from two sets of exploratory interviews that were conducted with adolescent end-users in order to better understand the factors that could contribute to their engagement with universal school-based digital mental health intervention programs. Through our exploratory effort on a topic that required urgent attention, we aimed to extend the body of knowledge pertaining to user experience of and user engagement with universal school-based digital mental health solutions, also the needs specific to the adolescents that are targeted for using these solutions.

This research project was envisioned to contribute to the practice by helping inform the user experience of school-based digital mental health solutions in order increase the likelihood of effectiveness of universal digital mental health interventions for high school students. We hope that our effort could raise more attention towards this topic in academia and practice, also could inspire further academic studies focused on identifying and addressing the needs of adolescent users pertaining to digital mental health resources.

References

Aschbrenner, K. A., Naslund, J. A., Tomlinson, E. F., Kinney, A., Pratt, S. I., & Brunette, M. F. (2019). Adolescents' use of digital technologies and preferences for mobile health coaching in public mental health settings. Frontiers in Public Health, 7. https://doi.org/10.3389/fpubh.2019.00178

American Psychological Association (APA). (2020). Stress in America™ 2020: A National Mental Health Crisis. https://www.apa.org/news/press/releases/stress/2020/sia-mental-health-crisis.pdf

Anglin, T. M. (2003). Mental health in schools. Handbook of School Mental Health: Advancing Practice and Research, 89–106. https://doi.org/10.1007/978-0-387-73313-5_7

Auster-Gussman, L. A., Lockwood, K. G., Graham, S. A., Pitter, V., & Branch, O. L. H. (2022). Engagement in Digital Health app-based prevention programs is associated with weight loss among adults age 65+. Frontiers in Digital Health, 4. https://doi.org/10.3389/fdgth.2022.886783

Babbage, C., Jackson, G. M., & Nixon, E. (2018). Desired features of a digital technology tool for self-management of well-being in a nonclinical sample of young people: Qualitative study. *JMIR Mental Health*, *5*(4). https://doi.org/10.2196/10067

Borghouts, J., Eikey, E. V., Mark, G., De Leon, C., Schueller, S. M., Schneider, M., Stadnick, N., Zheng, K., Mukamel, D. B., & Sorkin, D. H. (2021a). Understanding Mental Health app use among community college students: Web-based survey study. Journal of Medical Internet Research, 23(9). https://doi.org/10.2196/27745

Borghouts, J., Eikey, E., Mark, G., De Leon, C., Schueller, S. M., Schneider, M., Stadnick, N., Zheng, K., Mukamel, D., & Sorkin, D. H. (2021b). Barriers to and facilitators of user engagement with Digital Mental Health Interventions: Systematic Review. Journal of Medical Internet Research, 23(3). https://doi.org/10.2196/24387

Cefai, C., Camilleri, L., Bartolo, P., Grazzani, I., Cavioni, V., Conte, E., Ornaghi, V., Agliati, A., Gandellini, S., Tatalovic Vorkapic, S., Poulou, M., Martinsone, B., Stokenberga, I., Simões, C., Santos, M., & Colomeischi, A. A. (2022). The effectiveness of a school-based, Universal Mental Health Programme in six European countries. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.925614

Cohen Veterans Network. (2018, October). *America's mental health 2018*, 11. National Council for Mental Wellbeing (formerly known as National Council for Behavioral Health). https://www.cohenveteransnetwork.org/wp-content/uploads/2018/10/Research-Summary-10-10-2018.pdf

Fisak, B. J., Richard, D., & Mann, A. (2011). The prevention of child and adolescent anxiety: A meta-analytic review. Prevention Science, 12(3), 255–268. https://doi.org/10.1007/s11121-011-0210-0

Gan, D. Z. Q., McGillivray, L., Han, J., Christensen, H., & Torok, M. (2021). Effect of engagement with digital interventions on Mental Health Outcomes: A systematic review and meta-analysis. *Frontiers in Digital Health*, 3. https://doi.org/10.3389/fdgth.2021.764079

Garrido, S., Millington, C., Cheers, D., Boydell, K., Schubert, E., Meade, T., & Nguyen, Q. V. (2019). What works and what doesn't work? A systematic review of digital mental health interventions for depression and anxiety in young people. Frontiers in Psychiatry, 10. https://doi.org/10.3389/fpsyt.2019.00759

Gibbons , S. (2019, March 24). *User need statements: the 'Define' stage in Design Thinking*. Nielsen Norman Group. Retrieved June 27, 2022, from https://www.nngroup.com/articles/user-need-statements/

Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS Quarterly*, *19*(2), 213. https://doi.org/10.2307/249689

Merry, S. N., & Moor, S. (2015). School-based mental health interventions. In A. Thapar, D. S. Pine, J. F. Leckman, S. Scott, M. J. Snowling & E. Taylor (Eds.), *Rutter's child and adolescent psychiatry* (6th ed., pp. 545–558). chapter, Wiley-Blackwell.

McQuivey, J. (2013). Digital Consumers Want to Fulfill Their Needs. In *Digital Disruption: Unleashing the next wave of innovation* (pp. 54–68). essay, Forrester Research, Inc.

O'Dea, B., King, C., Subotic-Kerry, M., Achilles, M. R., Cockayne, N., & Christensen, H. (2019). Smooth sailing: A pilot study of an online, school-based, mental health service for depression and anxiety. Frontiers in Psychiatry, 10. https://doi.org/10.3389/fpsyt.2019.00574

Perski, O., Blandford, A., West, R., & Michie, S. (2016). Conceptualising engagement with Digital Behaviour Change Interventions: A systematic review using principles from Critical Interpretive Synthesis. *Translational Behavioral Medicine*, *7*(2), 254–267. https://doi.org/10.1007/s13142-016-0453-1

Radez, J., Reardon, T., Creswell, C., Lawrence, P. J., Evdoka-Burton, G., & Waite, P. (2021). Why do children and adolescents (not) seek and access professional help for their mental health problems? A systematic review of quantitative and qualitative studies. European Child & Adolescent Psychiatry, 30(2), 183–211. https://doi.org/10.1007/s00787-019-01469-4

Saleem, M., Kühne, L., De Santis, K. K., Christianson, L., Brand, T., & Busse, H. (2021). Understanding engagement strategies in digital interventions for mental health promotion: Scoping review. *JMIR Mental Health*, *8*(12), e30000. https://doi.org/10.2196/preprints.30000

Statistics Canada. (2020a, October). Impacts on Mental Health. https://www150.statcan.gc.ca/n1/pub/11-631-x/2020004/s3-eng.htm

Statistics Canada. (2020b, July). Canadian Health Survey on Children and Youth. https://www150.statcan.gc.ca/n1/daily-quotidien/200723/dq200723a-eng.htm

Szinay, D., Jones, A., Chadborn, T., Brown, J., & Naughton, F. (2020). Influences on the uptake of and engagement with health and well-being smartphone apps: Systematic review. *Journal of Medical Internet Research, 22*(5). https://doi.org/10.2196/17572

Tedder, M., Shi, L., Si, M., Franco, R., & Chen, L. (2015). Emindfulness therapy—a study on efficacy of blood pressure and stress control using mindful meditation and eating apps among people with high blood pressure. *Medicines, 2*(4), 298–309. https://doi.org/10.3390/medicines2040298

Torous, J., Nicholas, J., Larsen, M. E., Firth, J., & Christensen, H. (2018). Clinical Review of user engagement with mental health smartphone apps: Evidence, theory and improvements. *Evidence Based Mental Health, 21*(3), 116–119. https://doi.org/10.1136/eb-2018-102891

Ulrich, K. T., Eppinger, S. D., & Yang, M. C. (2020). Identifying Customer Needs. In *Product design and development,* (7th ed., pp. 77–94). essay, The McGraw-Hill Companies, Inc.

Wies, B., Landers, C., & Ienca, M. (2021). Digital Mental Health for Young People: A scoping review of ethical promises and challenges. Frontiers in Digital Health, 3. https://doi.org/10.3389/fdgth.2021.697072

Yilmaz, S. K., & Bohara, A. K. (2021). MHealth: Potentials and risks for addressing mental health and well-being issues among Nepali adolescents. Frontiers in Public Health, 9. https://doi.org/10.3389/fpubh.2021.563515

Appendix 1:

Procedures and Guides for the Interviews

(English Version)

At Least One Day Before the Interview

- To create the meeting schedule on Lookback
- To send an email to the selected participant with the link to join at the allocated time, also attach the users' consent form in the email to be signed by the participant.

Sample Email with Lookback Link to be Sent to the Participant (English Version)

Hello _____,

Thank you very much for your interest in participating in Tech3Lab and Dis-Moi's research.

We are writing to provide you with the link to participate in the interview, also with a consent form.

Please kindly read the information provided in the consent form, sign and attach the signed form in reply to this email before the start of our interview. If you have any questions concerning any part of the consent form, please do not hesitate to contact us or to reply to this email.

To join the interview on **<day>** at ***<Interview Time> <AM/PM>,*** please use the following link:

<Lookback Meeting's Link>

<Meeting Passcode, if applicable>

Thank you and we look forward to meeting you,

Erfan Badawi,

Tech3Lab, HEC Montréal

+1 (###) ### - ####

On the Time of the Interview

- To join the meeting 10–15 minutes ahead of time to adjust the call (audio/video) settings
- To ensure the cellphone is on silent mode and computer notifications are silent or disabled
- To wait for the participant to arrive and follow-up with the participant if not on the call after 5 minutes has passed from the allocated time of the interview
- To assist the participant when joined with call settings if required and proceed to interview briefing

Pre-Interview Briefing for The First Article's Interviews (English Version)

Hello _____,

My name is_____, and with my colleague _____, we will be interviewing you today.

First of all, thank you for participating in this study with us. Before we get started, there are a few things to review:

We are asking participants to answer questions regarding their experiences with well-being applications or digital platforms that will help improve well-being and have positive effect on mental health specifically for the young people of high school age. So, today, our focus is about digital mental health programs; not about you as an individual. We are only interested to know more about your experiences with and opinions about the well-being programs/trainings, because the aim of the team, Tech3lab & Dis-Moi, is to try to know how to build better well-being programs for youth. So, with that in mind, there is nothing you can say that is wrong. All answers are welcome and will help us with our project.

If you have any statements or thoughts as we move along, please feel free to express them as well. More importantly, if you feel not okay to answer one or some of the questions, we can move along to discuss other topics that would be more comfortable for you. As we also mentioned in the invitation and consent forms, we also have someone from Dis-Moi [present/on standby] who can help and support you if you would not feel positive to continue the interview. Please bear in mind this interview is strictly confidential, also it is voluntary, you may feel free to not continue at any time during the interview, but we hope you would!

[If Applicable:] Also, you can see that I have my colleague here who is interested in what you have to say as well. My colleague will primarily be taking notes and observing during this interview. He/She/They might or might not be joining the conversation.

Also, before starting the session, we would like to verify one-more time that you are aware and feel comfortable that we will be recording the audio of the session. [wait for confirmation]

We will check if we have received your signed consent form, but we want to clarify again the session's audio recording is only to discuss it with all the team members. No one other than the research team members would see the notes or hear the recordings and they all have signed confidentiality agreement to make sure your information and what you would say today is only accessible to us. That being said, you may want to ask us to delete the recording and our notes if you do not wish to continue with participating in our study, but your decision must be communicated with us up to 48 hours after our interview, before our notes from this session are combined with other interviews. In any case, your opinions and feedback will be kept anonymous throughout our analyses, meaning it would not be possible that your responses could be traced back to you.

We are hoping our interview would last around [30–40] minutes, depending on the conversations your answers will bring-out, but we have allocated a maximum of 45 minutes for this interview just in case.

If you have any questions at this point, please feel free to ask. If not, the session will start to be recorded now and we will start by asking you some questions. [wait for the green light from the participant]

Pre-Interview Briefing for The Second Article's Interviews (English Version)

Hello _____,

My name is_____, and with my colleague _____ we will be interviewing you today.

First of all, thank you for participating in this study with us. Before we get started, there are a few things to review:

We are asking participants to answer questions regarding their experiences with Dis-Moi's platform and the programs inside it. Our mission is to find how we can improve it as well-being program to help improve mental health of the young people of high school age. So, today, our focus is about your experiences with and opinions about Dis-Moi's platform and programs and it is not about you as an individual. So, with that in mind, there is nothing you can say that is wrong. All answers are welcome and will help us with our project.

If you have anything you need or want to discuss as we move along, please feel free to express them as well. More importantly, if you feel you are not okay to answer one or some of the questions, we can move along to discuss other topics that would be more comfortable for you. As we also mentioned in the invitation and consent forms, we also have someone from Dis-Moi [present/on call] who can help and support you if you would not feel positive to continue the interview. Please bear in mind this interview is strictly confidential, and it is voluntary, you may feel free to not continue at any time during the interview, but we really hope you would!

[If Applicable:] Also, you can see that I have my colleague here who is interested in what you have to say as well. My colleague will primarily be taking notes and observing during this interview. He/She/They might or might not be joining the conversation.

Also, before starting the session, we would like to verify one-more time that you are aware and feel comfortable that we will be recording the audio of the session. [wait for confirmation]

We have received your signed consent form, but we want to clarify again the session's audio recording is only to discuss it with all the team members. No one other than the research team members would see the notes or hear the recordings and they all have signed confidentiality agreement to make sure your information and what you would say today is only accessible to us. That being said, you may want to ask us to delete the recording and our notes if you do not wish to continue with participating in our study, but your decision must be communicated with us up to 48 hours after our interview, before our notes from this session are combined with other interviews' notes. In any case, your opinions and feedback will be kept anonymous throughout our analyses, meaning it would not be possible that your responses could be traced back to you.

We are hoping our interview would last around 30–40 minutes, depending on the answers and the conversation they will bring out, but we have allocated a maximum of 45 minutes for this interview, just in case. If you have any questions at this point, please feel free to ask. If not, the session will start to be recorded now and we will start by asking you some questions. [wait for the green light from the participant]

Attitudes to Adopt during the interview

- Empathy
    - Read nonverbal cues and put yourself in the participant's shoes
- Unconditional acceptance
    - Openness to interviewee, accept their view of the world, show interest in what they say
- Non-directiveness
    - Do not try to influence in any way the participant's thoughts, behaviors or values

Sample of Interview Questions for the Supporting Set of Participants (First Article) – EN Version

- Tell us about the times you had used a mental health resource (program/training/service).
    - 'When', 'Why' and 'How' did you use this resource (program/training/service)?
- Tell us about some **positive experiences** that you have had with well-being resources.
    - What aspects/features of the resource did you like? **And why?**
- Tell us about some **negative experiences** that you have had with well-being resources.
    - What aspects/features of the resource did you dislike in these experiences? **And why?**
- What would you **improve** in well-being programs/trainings/services you have used? **Explain why**.

Sample of Interview Questions for the Main Set of Participants (Second Article) – EN Version

- Tell us about some of your experiences with Dis-Moi's digital well-being platform.
    - 'When', 'Why' and 'How' did you use Dis-Moi's platform, its programs and resources?
- For each of the following features or aspects:
    - Tell us about some of the **positive experiences** that you have had with them.
    - Tell us about some of the **negative experiences** that you have had with them.
    - What would you improve in them? Please explain **why**.
    - The learning materials and activities within the programs that you had participated
    - The relevance and depth of the offered weekly or monthly themed programs and activities
    - The user dashboards
    - The announcements (general ones and also the ones related to specific programs)
    - The gamified aspects of the learning experience and the overall leaderboard/point system
- Overall, what would you **improve** in Dis-Moi's well-being program(s) you have used? **Explain why**.
- Overall, what would you **improve** in Dis-Moi's platform? **Explain why**.

In case of emergencies (Student is in distress, etc.)

Only if **[the psychologist]** expresses being on-call for the interview:

To stop the interview and to give contact number**: ###-###-####**

If **[the psychologist]** would not be available:

To stop the interview, provide the **Tel-Jeunes** number to participant to instantly contact **1 800 263-2266**

Wrapping Up the Interview (English Version)

Before concluding, verify if the participant has anything else to discuss:

Any other thoughts you wanted to share with us about the questions, the discussions, our session or something else, before we conclude the session?

Provide the **compensation form** to the participant, then conclude the session:

[After the interviewer/notetaker emails the compensation form to the interviewee]: Now, please check your email to confirm you have received the compensation form. *[wait for confirmation]* After we receive the completed form, we will immediately transfer it to the appropriate channels to proceed with the payment. You will receive your chosen gift card between 7 to 10 days later. Thank you very much for your valuable participation! It was great to have you today and your comments were very interesting and will be truly helpful for our research project. Have a nice [day/evening]. Goodbye.

Appendix 2:

Bibliography

Ahlen, J., Lenhard, F., & Ghaderi, A. (2015). Universal prevention for anxiety and depressive symptoms in children: A meta-analysis of randomized and cluster-randomized trials. *The Journal of Primary Prevention*, *36*(6), 387–403. https://doi.org/10.1007/s10935-015-0405-4

American Psychological Association. (2020). *Stress in America™ 2020: A National Mental Health Crisis*. American Psychological Association. Retrieved February 10, 2022, from https://www.apa.org/news/press/releases/stress/2020/sia-mental-health-crisis.pdf

Anglin, T. M. (2003). Mental health in schools. *Handbook of School Mental Health: Advancing Practice and Research*, 89–106. https://doi.org/10.1007/978-0-387-73313-5_7

Aschbrenner, K. A., Naslund, J. A., Tomlinson, E. F., Kinney, A., Pratt, S. I., & Brunette, M. F. (2019). Adolescents' use of digital technologies and preferences for mobile health coaching in public mental health settings. Frontiers in Public Health, 7. https://doi.org/10.3389/fpubh.2019.00178

Auster-Gussman, L. A., Lockwood, K. G., Graham, S. A., Pitter, V., & Branch, O. L. H. (2022). Engagement in Digital Health app-based prevention programs is associated with weight loss among adults age 65+. Frontiers in Digital Health, 4. https://doi.org/10.3389/fdgth.2022.886783

Babbage, C., Jackson, G. M., & Nixon, E. (2018). Desired features of a digital technology tool for self-management of well-being in a nonclinical sample of young people: Qualitative study. *JMIR Mental Health*, *5*(4). https://doi.org/10.2196/10067

Barrett, P. M., Lock, S., & Farrell, L. J. (2005). Developmental differences in Universal Preventive Intervention for Child Anxiety. *Clinical Child Psychology and Psychiatry*, *10*(4), 539–555. https://doi.org/10.1177/1359104505056317

Borghouts, J., Eikey, E. V., Mark, G., De Leon, C., Schueller, S. M., Schneider, M., Stadnick, N., Zheng, K., Mukamel, D. B., & Sorkin, D. H. (2021a). Understanding Mental Health app use among community college students: Web-based survey study. Journal of Medical Internet Research, 23(9). https://doi.org/10.2196/27745

Borghouts, J., Eikey, E., Mark, G., De Leon, C., Schueller, S. M., Schneider, M., Stadnick, N., Zheng, K., Mukamel, D., & Sorkin, D. H. (2021b). Barriers to and facilitators of user engagement with Digital Mental Health Interventions: Systematic Review. Journal of Medical Internet Research, 23(3). https://doi.org/10.2196/24387

Canadian Health Survey on Children and Youth, 2019. Government of Canada, Statistics Canada . (2020, July). Retrieved February 10, 2022, from https://www150.statcan.gc.ca/n1/daily-quotidien/200723/dq200723a-eng.htm

Cefai, C., Camilleri, L., Bartolo, P., Grazzani, I., Cavioni, V., Conte, E., Ornaghi, V., Agliati, A., Gandellini, S., Tatalovic Vorkapic, S., Poulou, M., Martinsone, B., Stokenberga, I., Simões, C., Santos, M., & Colomeischi, A. A. (2022). The effectiveness of a school-based, Universal Mental Health Programme in six European countries. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.925614

Clarke, A. M., Kuosmanen, T., & Barry, M. M. (2014). A systematic review of Online Youth Mental Health Promotion and prevention interventions. *Journal of Youth and Adolescence, 44*(1), 90–113. https://doi.org/10.1007/s10964-014-0165-0

Fisak, B. J., Richard, D., & Mann, A. (2011). The prevention of child and adolescent anxiety: A meta-analytic review. *Prevention Science, 12*(3), 255–268. https://doi.org/10.1007/s11121-011-0210-0

Gan, D. Z. Q., McGillivray, L., Han, J., Christensen, H., & Torok, M. (2021). Effect of engagement with digital interventions on Mental Health Outcomes: A systematic review and meta-analysis. *Frontiers in Digital Health, 3*. https://doi.org/10.3389/fdgth.2021.764079

Garrido, S., Millington, C., Cheers, D., Boydell, K., Schubert, E., Meade, T., & Nguyen, Q. V. (2019). What works and what doesn't work? A systematic review of digital mental health interventions for depression and anxiety in young people. Frontiers in Psychiatry, 10. https://doi.org/10.3389/fpsyt.2019.00759

Gibbons , S. (2019, March 24). *User need statements: The 'Define' Stage in Design Thinking*. Nielsen Norman Group. Retrieved June 27, 2022, from https://www.nngroup.com/articles/user-need-statements/

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: Interviews and focus groups. *British Dental Journal*, *204*(6), 291–295. https://doi.org/10.1038/bdj.2008.192

Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS Quarterly, 19*(2), 213. https://doi.org/10.2307/249689

Impacts on mental health. Government of Canada, Statistics Canada. (2020, October). Retrieved February 10, 2022, from https://www150.statcan.gc.ca/n1/pub/11-631-x/2020004/s3-eng.htm

ISO 9241-210:2019(en) Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems. International Organization for Standardization. (2019). Retrieved February 10, 2022, from https://www.iso.org/obp/ui/#!iso:std:77520:en

Masia-Warner, C., Nangle, D. W., & Hansen, D. J. (n.d.). *Bringing evidence-based child mental health services to the schools: General issues and specific populations*. DigitalCommons@University of Nebraska - Lincoln. Retrieved June 15, 2021, from https://digitalcommons.unl.edu/psychfacpub/71

McQuivey, J. (2013). Digital Consumers Want to Fulfill Their Needs. In *Digital Disruption: Unleashing the next wave of innovation* (pp. 54–68). essay, Forrester Research, Inc.

Mental Health Commission of Canada. (2022). *E-Mental Health*. E-Mental Health - Mental Health Commission of Canada. photograph. Retrieved from https://mentalhealthcommission.ca/what-we-do/e-mental-health/

Merry, S. N., & Moor, S. (2015). School-based mental health interventions. In A. Thapar, D. S. Pine, J. F. Leckman, S. Scott, M. J. Snowling & E. Taylor (Eds.), *Rutter's child and adolescent psychiatry* (6th ed., pp. 545–558). chapter, Wiley-Blackwell.

National Council for Mental Wellbeing (formerly known as National Council for Behavioral Health). (2018, October 10). *America's mental health 2018*. Cohen Veterans Network. Retrieved June 11, 2022, from https://www.cohenveteransnetwork.org/americasmentalhealth/

Neil, A. L., & Christensen, H. (2009). Efficacy and effectiveness of school-based prevention and early intervention programs for anxiety. *Clinical Psychology Review*, *29*(3), 208–215. https://doi.org/10.1016/j.cpr.2009.01.002

O'Dea, B., King, C., Subotic-Kerry, M., Achilles, M. R., Cockayne, N., & Christensen, H. (2019). Smooth sailing: A pilot study of an online, school-based, mental health service for depression and anxiety. Frontiers in Psychiatry, 10. https://doi.org/10.3389/fpsyt.2019.00574

Perski, O., Blandford, A., West, R., & Michie, S. (2016). Conceptualising engagement with Digital Behaviour Change Interventions: A systematic review using principles from Critical Interpretive Synthesis. *Translational Behavioral Medicine*, *7*(2), 254–267. https://doi.org/10.1007/s13142-016-0453-1

Radez, J., Reardon, T., Creswell, C., Lawrence, P. J., Evdoka-Burton, G., & Waite, P. (2020). Why do children and adolescents (not) seek and access professional help for their mental health problems? A systematic review of Quantitative and Qualitative Studies. *European Child & Adolescent Psychiatry*, *30*(2), 183–211. https://doi.org/10.1007/s00787-019-01469-4

Saleem, M., Kühne, L., De Santis, K. K., Christianson, L., Brand, T., & Busse, H. (2021). Understanding engagement strategies in digital interventions for Mental Health Promotion: Scoping Review (preprint). https://doi.org/10.2196/preprints.30000

Spies, R., Grobbelaar, S., & Botha, A. (2020). A scoping review of the application of the task-technology fit theory. *Lecture Notes in Computer Science*, 397–408. https://doi.org/10.1007/978-3-030-44999-5_33

Stallard, P., Skryabina, E., Taylor, G., Phillips, R., Daniels, H., Anderson, R., & Simpson, N. (2014). Classroom-based cognitive behaviour therapy (friends): A cluster randomised controlled trial to prevent anxiety in children through education in schools (paces). *The Lancet Psychiatry*, *1*(3), 185–192. https://doi.org/10.1016/s2215-0366(14)70244-5

Szinay, D., Jones, A., Chadborn, T., Brown, J., & Naughton, F. (2020). Influences on the uptake of and engagement with health and well-being smartphone apps: Systematic review. *Journal of Medical Internet Research*, *22*(5). https://doi.org/10.2196/17572

Tedder, M., Shi, L., Si, M., Franco, R., & Chen, L. (2015). Emindfulness therapy—a study on efficacy of blood pressure and stress control using mindful meditation and eating apps among people with high blood pressure. *Medicines*, *2*(4), 298–309. https://doi.org/10.3390/medicines2040298

Torous, J., Nicholas, J., Larsen, M. E., Firth, J., & Christensen, H. (2018). Clinical Review of user engagement with mental health smartphone apps: Evidence, theory and improvements. *Evidence Based Mental Health*, *21*(3), 116–119. https://doi.org/10.1136/eb-2018-102891

Ulrich, K. T., Eppinger, S. D., & Yang, M. C. (2020). Identifying Customer Needs. In *Product design and development*, (7th ed., pp. 77–94). essay, The McGraw-Hill Companies, Inc.

Wies, B., Landers, C., & Ienca, M. (2021). Digital Mental Health for Young People: A scoping review of ethical promises and challenges. Frontiers in Digital Health, 3. https://doi.org/10.3389/fdgth.2021.697072

Yilmaz, S. K., & Bohara, A. K. (2021). MHealth: Potentials and risks for addressing mental health and well-being issues among Nepali adolescents. Frontiers in Public Health, 9. https://doi.org/10.3389/fpubh.2021.563515