

What are you thinking?: Using CBT and Storytelling to Improve Mental Health Among College Students

你在想什么?: 运用认知行为疗法和讲故事改善大学生心理健康

Aleesha Hamid
阿利莎·哈米德
aleesha.hamid@lums.edu.pk
Aleesha.hamid@lums.edu.pk
Lahore University of
Management
拉合尔管理大学
Sciences
科学
Lahore, Pakistan
拉合尔, 巴基斯坦

Rabiah Arshad
Rabiah Arshad
rbarshad@uw.edu
Rbarshad@uw.edu
Lahore University of Management
拉合尔管理大学
Sciences
科学
Lahore, Pakistan
拉合尔, 巴基斯坦

Suleman Shahid
苏勒曼·沙希德
suleman.shahid@lums.edu.pk
Suleman shahid@lums.edu.pk
Lahore University of
Management
拉合尔管理大学
Sciences
科学
Lahore, Pakistan
拉合尔, 巴基斯坦



Figure 1: Core concept of CBT: understanding the link between emotions, thoughts and behaviours

图 1: 认知行为疗法的核心概念: 理解情绪、思想和行为之间的联系

ABSTRACT

摘要

Depression and anxiety among college students have been on the rise globally. Cognitive Behavioural Therapy has emerged as an empirically reinforced and effective treatment. However, factors like cost, lack of resources, misguided prioritization and stigmatization of mental health issues in the Global South limit students' access to psychotherapy. While technology can bridge this gap, research shows current self-guided mHealth apps for CBT are not always evidence-based and have limited efficacy compared to therapist-guided alternatives. In this paper, we explore whether interactive storytelling and other gamification mechanisms can increase the efficacy of a self-guided mHealth app, while drawing from empirically supported CBT protocols. We designed an mHealth application with contextualised storylines to help students learn psychological concepts and better identify the negative patterns in their thoughts. We present the results of a 3-arm randomized controlled trial conducted to assess the effect of this application compared to active and inactive control conditions.

大学生的抑郁和焦虑在全球范围内呈上升趋势。认知行为疗法已经成为一种经验性强化和有效的治疗方法。然而,诸如成本、缺乏资源、误导性的优先考虑和对南半球心理健康问题的污名化等因素限制了学生接受心理治疗的机会。虽然技术可以弥补这一差距,但研究表明,目前用于认知行为疗法的自我引导的移动健康应用程序并不总是以证据为基础的,与治疗师引导的替代方案相比,效果有限。在本文中,

我们借鉴经验支持的认知行为疗法协议,探讨交互式讲故事和其他游戏化机制是否能够提高自导式移动健康应用程序的效率。我们设计了一个具有情境化故事情节的 mHealth 应用程序,以帮助学生学习心理学概念,并更好地识别他们思想中的消极模式。我们提出了一个三组随机对照试验的结果,以评估这种应用的效果,比较主动和非主动控制条件。

CCS CONCEPTS

CCS 概念

- Human centred computing → Human computer interaction(HCI); Interaction Design.

以人为中心的计算→人机交互;交互设计。

KEYWORDS

关键词

mental health, mHealth application, CBT, storytelling
心理健康, 移动健康应用, 认知行为疗法, 讲故事

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

允许制作本作品的全部或部分供个人或教室使用的数字或硬拷贝，但不得为获利或商业利益而制作或分发副本，并在第一页印有本通知和完整引文。除 ACM 以外的其他人拥有本作品的组成部分的版权必须得到尊重。允许使用信用进行摘要。以其他方式复制，或者重新发布，在服务器上发布或者重新发布到列表上，需要事先获得特定的许可和/或者收取费用。向 permissions@acm.org 请求权限。

Woodstock '18, June 03–05, 2018, Woodstock, NY 2022 Association for Computing Machinery. ACM ISBN 978-1-4503-9157-3/22/04... \$15.00
<https://doi.org/10.1145/3491102.3517603>

Woodstock'18, June 03-05,2018, Woodstock, NY 2022 计算机协会. ACM ISBN 978-1-4503-9157-3/22/04. \$15.00
<https://doi.org/10.1145/3491102.3517603>

ACM Reference Format:

ACM 参考格式:

Aleesha Hamid, Rabiah Arshad, and Suleman Shahid. 2022. What are you thinking?: Using CBT and Storytelling to Improve Mental Health Among College Students. In Woodstock '18: ACM Symposium on Neural Gaze Detection, June 03–05, 2018, Woodstock, NY . ACM, New York, NY, USA, 16 pages. <https://doi.org/10.1145/3491102.3517603>

Aleesha Hamid Rabiah Arshad 和 Suleman Shahid. 2022 年。你在想什么？运用认知行为疗法和讲故事改善大学生的心理健康。In Woodstock'18: ACM Symposium on Neural Gaze detection, June 03-05,2018, Woodstock, NY 伍德斯托克'18: ACM 神经凝视检测研讨会, 2018 年 6 月 3 日至 5 日, 纽约. ACM, 纽约, 纽约, 美国, 16 页。
<https://doi.org/10.1145/3491102.3517603>

1 INTRODUCTION

引言

Mental disorders are highly prevalent among the general population and have been recognized as a major disease burden globally. According to the World Health Organization (WHO), depression is the leading cause of disability worldwide [2]. For college students in particular, the incidence of depression and anxiety is a growing concern and has been described as an epidemic [18]. They are at a vulnerable stage of life, as the age of initial onset for most psychiatric disorders is between 18 and 24 [60]. Moreover, college students are in a phase of their lives known in developmental psychology literature as “emerging adulthood” [8] where they are faced with a number of unique stressors as a result of transitioning into independent living, their first experience with adult responsibilities, and often a significant transition into a new lifestyle and environment, as many young adults move away from home for college. Other factors such as academic stress, social and financial pressures and a changing sense of self or identity can contribute to a heightened level of psychological distress [3].

精神障碍在一般人群中非常普遍，已被认为是全球的一个主要疾病负担。根据世界卫生组织(WHO)，抑郁症是全球残疾的主要原因[2]。尤其是对于大学生来说，抑郁症和焦虑症的发病率越来越受到关注，并被描述为流行病[18]。他们处于生命的脆弱阶段，因为大多数精神疾病的初始发病年龄在 18 至 24 岁之间[60]。此外，在发展心理学文献中，大学生正处于一个被称为“成年初期”的人生阶段，他们面临着许多独特的压力源，因为他们正在过渡到独立生活，他们第一次体验到成年人的责任，而且往往是一个重要的过渡到新的生活方式和环境，因为许多年轻人离家上大学。其他因素，如学业压力、社会和经济压力以及自我意识或身份认同的改变，都可能导致心理压力的加剧[3]。

Despite the prevalence of mental health difficulties, college students still face several barriers to appropriate care and the majority of individuals in need of mental health services receive no treatment [49]. This is due to factors such as privacy concerns, high treatment costs, time constraints, misguided prioritization of mental wellbeing, and a dearth of available resources. Additionally, the issue of stigma around mental health is particularly pertinent in the Global South [56], which is where our research took place. Given the growing number of students facing mental health issues in college, existing cost effective solutions such as on-campus counselling services are often unable to cope with such a heavy load [1].

尽管普遍存在心理健康问题，但大学生在获得适当护理方面仍面临一些障碍，大多数需要心理健康服务的个人得不到治疗[49]。这是由

于诸如隐私问题、高昂的治疗费用、时间限制、对男性心理健康的错误优先考虑以及可用资源的匮乏等因素造成的。此外，围绕心理健康的耻辱问题在我们的研究发生的地方 **Global South** [56]中特别相关。鉴于越来越多的学生在大学期间面临心理健康问题，现有的成本效益高的解决方案，如校园咨询服务，往往无法应付如此沉重的负担[1]。

Cognitive Behavioural Therapy (CBT) has emerged as a viable, empirically reinforced treatment that has been shown to be effective for various mental health issues including depression and anxiety [72]. CBT is a goal oriented psychotherapy that focuses on identifying automatic thoughts and changing the thought patterns that adversely affect people's feelings and behaviours, and subsequently improving their perceptions or feelings [44]. It posits that in any event there will be a trigger, an interpretation, and a reaction. In most cases, distorted thinking patterns, or cognitive distortions, result in a misinterpretation or disproportionate reaction to events, resulting in negative feelings and poor mental health. These cognitive distortions are biased perspectives and irrational thoughts and beliefs that people tend to unknowingly reinforce over time. The key concept of CBT, therefore, concentrates on the way information is processed and perceived. Once a person begins to see these negative thinking patterns, they can then re-evaluate and re-frame them and hence develop coping skills and think in a healthier manner.

认知行为疗法(CBT)已经成为一种可行的、经验上强化的治疗方法,已被证明对包括抑郁和焦虑在内的各种心理健康问题有效[72]。认知行为疗法是一种以目标为导向的心理治疗方法,其重点是识别无意识的想法,改变对人们的感受和行为产生不利影响的思维模式,并随后改善他们的感知或感觉[44]。它假定在任何情况下都会有触发,解释和反应。在大多数情况下,扭曲的思维模式,或认知扭曲,导致误解或不成比例的反应事件,导致负面情绪和不良的心理健康。这些认知扭曲是有偏见的观点和非理性的想法和信念,人们往往会不知不觉地加强随着时间的推移。因此,认知行为疗法的关键概念集中在信息处理和感知的方式上。一旦一个人开始看到这些消极的思维模式,他们就可以重新评估和重新定义它们,从而发展应对技能,以一种更健康的方式思考。

CBT is typically delivered in a clinical environment by a psychotherapist over a number of sessions, where the therapist talks to patients face-to-face and helps them to identify their negative thoughts so that the patient may learn to respond to situations in a more effective way. Given the various obstacles preventing access to psychotherapy, there are many digital methods of CBT delivery being explored. Therapist-guided CBT apps have been shown to be as effective as face-to-face sessions [26], and while self-guided digital interventions are also effective, the balance of evidence favours a guided approach offering some level of human support [16]. There is a need to investigate how to improve the efficacy of entirely self-guided interventions as this would make psychotherapy more accessible to a larger number of people while also providing the benefit of anonymity which is particularly important in the Global South context given the issue of stigmatization.

认知行为疗法通常由心理治疗师在临床环境中进行多次治疗,治疗师与患者面对面交谈,帮助他们识别他们的消极想法,以便患者可以学会以更有效的方式对情况作出反应。考虑到心理治疗的各种障碍,有许多数字化的认知行为疗法正在被探索。治疗师指导的认知行为疗法应用程序已被证明与面对面治疗同样有效[26],而自我指导的数字干预也同样有效,证据的平衡倾向于提供一定程度的人类支持的指导方法[16]。有必要研究如何提高完全自我引导的干预措施的效力,因为这将使更多的人更容易获得心理治疗,同时也提供匿名的好处,鉴于污名化问题,匿名在全球南方的背景下尤为重要。

Therapeutic alliance is a major factor that contributes significantly to the efficacy of therapies [43, 66], but is not adequately represented in digital interventions. The traditional conceptualisation of a therapeutic alliance includes 3 components: the bond between the client and therapist, agreement on tasks and agreement on therapeutic goals [19]. Existing research attempting to understand the effects of these components in order to reconceptualise the traditional definition to fit within digital environments highlights that a therapeutic alliance may be associated with increased engagement and adherence [6, 23]. This finding is in line with research showing that engagement and adherence are themselves associated with improved outcomes in digital interventions [30, 39, 40, 51]. Therefore it follows that in order to incorporate or emulate this alliance in the absence of human support, digital interventions should incorporate features and strategies such as availability, interactivity and personalisation in order to foster a bidirectional relationship between the user and the application and support a user's motivation to engage [87]. A systematic re-view of existing CBT apps showing that none of the assessed apps offered any form of personalisation beyond usernames and appropriate pronouns [67], and the alarmingly high attrition rates among mHealth apps [41, 42, 86] make it clear that this is a high priority research area. In fact, the James Lind Alliance Priority Setting Partnership that was established to identify key research priorities in

治疗联盟是一个主要因素,对治疗效果有显著贡献[43,66],但在数字干预中没有充分代表。治疗联盟的传统概念包括 3 个组成部分:患者和治疗师之间的联系,任务的一致性和治疗目标的一致性[19]。现有的研究试图理解这些成分的影响,以便重新概念化传统的定义。它在数字环境中强调,治疗联盟可能与增加参与度和依从性有关[6,23]。这一结果与研究结果一致,研究表明参与和坚持本身就与数字干预的改善结果有关[30,39,40,51]。因此,为了在没有人力支持的情况下纳入或效仿这种联盟,数字干预措施应纳入可用性、互动性和个性化等特征和战略,以促进用户和应用程序之间的双向关系,并支持用户参与的动机[87]。对现有的认知行为疗法应用程序的系统回顾显示,除了用户名和合适的代词之外,没有任何被评估的应用程序提供任何形式的个性化服务[67],而移动健康应用程序的流失率高得惊人[41,42,86]清楚地表明,这是一个高度优先的研究领域。事实上,詹姆斯林德联盟优先设置部分合作关系是为了确定关键的研究重点而建立的。

advancing digital interventions also highlighted concerns relating to therapeutic alliance in the top ten key issues raised [52].
推进数字干预也突出了前十个关键问题中与治疗联盟有关的担忧[52]。

In this paper, we propose a new method of incorporating CBT into a self-guided mHealth application that uses gamification strategies to foster a therapeutic alliance to improve efficacy. We use gamification in particular because research has shown it has potential to increase a user's engagement as well as intrinsic motivation which can create a relationship between the user and the application and therefore emulate a therapeutic alliance within a digital intervention.

在本文中，我们提出了一种新的方法，将认知行为疗法(CBT)融入到一个自我引导的移动健康应用程序中，该应用程序使用游戏化策略来促进治疗联盟以提高疗效。我们之所以使用游戏化，是因为研究表明，它有可能提高用户的参与度和内在动机，从而在用户和应用程序之间建立关系，从而在数字干预中模仿治疗联盟。

We present the design of a gamified mobile application that leverages the power of storytelling to enable users to identify their own unhealthy thinking patterns (cognitive distortions) and create a sense of cognitive awareness. Furthermore, we hypothesise that the interactive scenarios and contextualised storylines can not only educate users about the psychological concepts that underpin the process of CBT but also enable the internalisation of these learned concepts by allowing users to see how they are directly related to situations occurring in their everyday lives. We conducted a 3-arm randomized controlled trial as our objective was not only to assess the efficacy of our application and understand how to better design CBT interventions, but also to investigate whether the incorporation of gamification elements to emulate a therapeutic alliance could increase the efficacy of self-guided CBT interventions. To understand whether these elements in particular led to the improved efficacy, the study design had to include a control condition and hence a comparison of our gamified application with a non-gamified version of the same underlying intervention, i.e. a commercially available mHealth application delivering CBT. Therefore, our contributions also include the recommendations and insights derived from the results of this RCT.

我们提出了一个游戏化的移动应用程序的设计，利用讲故事的力量，使用户能够识别自己不健康的思维模式(认知扭曲)，并创造一种认知意识的感觉。此外，我们假设互动场景和情境化的故事情节不仅可以教育用户了解支持认知行为疗法的心理学概念，而且还可以让用户看到这些学到的概念如何与他们日常生活中发生的情况直接相关，从而使这些概念内化。我们进行了一项三组随机对照试验，因为我们的目标不仅是评估我们的应用效果和了解如何更好地设计认知行为疗法干预措施，而且还要研究是否将游戏化因素纳入模拟治疗联盟可以提高自我引导的认知行为疗法干预措施的效果。为了理解这些因素是否特别导致了效果的提高，研究设计必须包括一个控制条件，因此必须将我们的游戏化应用程序与非游戏化版本的相同基础干预措施进行比较，即商业上可获得的提供 CBT 的移动健康应用程序。因此，我们的贡献也包括来自这个随机对照试验结果的建议和见解。

2 RELATED WORKS

相关工程

2.1 Cognitive Behavioural Therapy

2.1 认知行为疗法

Cognitive Behavioural Therapy provides a structured approach for recognising and addressing negative thinking patterns, due to which it is well suited to being adapted to digital platforms both as therapist-guided [59] and self-guided [57] interventions. Overall, digital CBT has been shown to be effective, although a range of meta analyses show that therapist-guided or supported interventions have a greater effect than self-guided interventions, and are comparable to face-to-face therapy in their efficacy [11, 16, 26, 34, 46, 89].

认知行为疗法为识别和处理消极思维模式提供了一种结构化的方法，因此它非常适合作为治疗师指导和自我指导的干预手段适应数字平台。总体而言，数字认知行为疗法已被证明是有效的，尽管一系列荟萃分析显示，治疗师指导或支持的干预措施比自我指导的干预措施有更大的效果，并且在其有效性方面与面对面治疗相当[11,16,26,34,46,89]。

Guided CBT apps differ in the level of therapist involvement. Some guided apps are used by mental health professionals simply for screening and assessment, others to assist patients with CBT homework exercises or to log their thoughts and moods between sessions, and some are used simply to aid face-to-face therapy. Sanvello, a guided CBT app for depression and anxiety, provides psychoeducational modules, mood tracking, coping tools to deal with stressful situations, peer support and remote contact with a therapist [70]. A randomized trial conducted to assess the efficacy of remote CBT for panic disorder supplemented the program with brief regular contact with a therapist over weekly telephone calls

指导性 CBT 应用程序在治疗师参与水平上有所不同。有些指导性应用程序只是精神健康专业人员用来进行筛查和评估的，有些则用来帮助病人进行认知行为疗法的家庭作业练习或记录他们的思想和情绪，还有一些仅仅用来辅助面对面治疗。Sanvello 是一款针对抑郁和焦虑的认知行为疗法(CBT)应用程序，提供心理教育模块、情绪追踪、处理压力情况的应对工具、同伴支持以及与治疗师的远程联系。为评估远程 CBT 治疗恐慌症的疗效而进行的一项随机试验补充了该计划，每周通过电话与治疗师进行短暂的定期联系

[27]. PeskygNATs, a series of four custom-built game-based CBT interventions, is another solution designed to aid therapists during PeskygNATs, 一系列四个定制的基于游戏的认知行为疗法干预，是另一个解决方案，旨在帮助治疗师

What are you thinking?
你在想什么？

face-to-face sessions and also to assist patients between sessions [88].

面对面的会议，也协助病人之间的会议[88]。

There are also numerous mHealth apps delivering entirely self-guided CBT, and these too vary greatly in their therapeutic content. A recent systematic assessment of 98 self-guided CBT apps revealed a heterogeneous group offering a range of evidence-based and non evidence-based techniques. Approximately only one-third of these apps offered comprehensive, evidence-based CBT programs that could actually benefit users who don't have access to psychotherapy [67]. This finding is in line with other work such as another study that conducted an analysis of 31 CBT apps for depression, and found that only half of all the features provided by apps reflected the core competencies of CBT [83]. Among apps containing evidence-based therapeutic elements, cognitive restructuring (assessment and analysis of the user's own automatic thoughts typically using thought records) is the most common, followed by psychoeducation (text or video content explaining the different cognitive distortions and automatic thoughts) and behavioural activation (modules to schedule and track activities). Approximately half the assessed apps also included one or more non-CBT based features, such as journal tools for unstructured writing and self reflection, gratitude and affirmations etc. The number and combination of therapeutic features available in CBT apps also varies; for example, MEMO

还有许多 mHealth 应用程序提供完全自我引导的 CBT，这些应用程序的治疗内容也有很大差异。最近对 98 个自我引导的 CBT 应用程序进行的系统评估揭示了一个提供一系列循证和非循证技术的异质性组。这些应用程序中大约只有三分之一提供了全面的、基于证据的认知行为疗法(CBT)程序，这些程序实际上可以帮助那些无法接受心理治疗的用户[67]。这一结果与其他研究结果一致，比如另一项研究对 31 款用于治疗抑郁症的认知行为疗法(CBT)应用程序进行了分析，结果发现，应用程序提供的所有功能中，只有一半反映了 CBT 的核心能力[83]。在包含循证治疗元素的应用程序中，认知重构(通常使用思维记录来评估和分析用户自己的自动思维)是最常见的，其次是心理教育(解释不同认知扭曲和自动思维的文本或视频内容)和行为激活(安排和跟踪活动的模块)。大约一半的评估应用程序还包括一个或多个非认知行为疗法的功能，例如用于非结构化写作和自我反省的日记工具，感恩和结构化等。认知行为疗法应用程序中可用的治疗功能的数量和组合也各不相同；例如，备忘录

[91] is a depression prevention intervention focusing solely on psychoeducation, MoodHacker [17] combines CBT strategies with other positive-psychology based strategies, and other apps such as MoodKit [10] and MoodTools [83] incorporate self-monitoring, mood-tracking and journal features alongside psychoeducation. It can also be seen that classifying CBT apps into those catering exclusively to depression and those that improve general mental health and mental wellbeing shows that depression apps consistently offer more evidence based techniques whereas the latter two are substantially less adherent [67].

是一种只关注心理教育的抑郁预防干预措施，MoodHacker 将认知行为疗法(CBT)策略与其他基于积极心理学的策略相结合，其他应用程序如 MoodKit 和 MoodTools 将自我监控、情绪跟踪和日记功能与心理教育相结合。我们还可以看到，将认知行为疗法(CBT)应用程序分类为专门为抑郁症服务的应用程序和那些能够改善一般心理健康和心理健康的应用程序，这表明抑郁症应用程序一贯地提供更多基于证据的技术，而后两种应用程序的依附性则大大降低[67]。

Very few apps contain engagement features such as gamification and almost none of them offer personalized content beyond usernames and gender-appropriate pronouns. This finding is also corroborated by other reviews showing a lack of explicit engagement features in CBT apps [54, 83], despite the conceptualization of a therapeutic alliance in digital interventions indicating that tailoring content, personalization and other interactive features can facilitate user engagement and improve adherence [20, 87].

很少有应用程序包含 gamification 等参与功能，几乎没有一个应用程序提供超出用户名和性别适当代词的个性化内容。这一结果也得到了其他评论的证实，这些评论表明认知行为疗法应用程序缺乏明确的参与特征[54,83]，尽管数字干预中的治疗联盟的概念化表明，量身定制的内容、个性化和其他互动特征可以促进用户参与和提高依从性[20,87]。

This review of existing CBT mHealth applications shows that while there are many available solutions, there is a need to improve the efficacy of self-guided interventions to bring them up to par with guided or supported interventions, and to ensure that they are comprised of evidence-based therapeutic elements while also creating a therapeutic alliance through strategies to promote engagement and motivation.

这次对现有 CBT 移动健康应用的审查表明，虽然有许多可用的解决办法，但有必要提高自我引导干预措施的效力，使其达到引导或支持干预措施的水平，并确保这些措施包括循证治疗要素，同时通过促进参与和动机的战略建立治疗联盟。

2.2 Gamification

2.2 游戏化

The central idea behind gamification is to harness the motivational potential of video games by transferring game design elements to non-game environments [37]. Even though gamification is a relatively new concept, its potential cost-effectiveness, accessibility, and flexibility, as well as the increasing popularity of video games have led to it being applied to a variety of contexts. It has been argued that the core idea behind gamification is to transfer game design elements to non-game environments [37]. The central idea behind gamification is to harness the motivational potential of video games by transferring game design elements to non-game environments [37]. Even though gamification is a relatively new concept, its potential cost-effectiveness, accessibility, and flexibility, as well as the increasing popularity of video games have led to it being applied to a variety of contexts. It has been argued that the core idea behind gamification is to transfer game design elements to non-game environments [37]. The central idea behind gamification is to harness the motivational potential of video games by transferring game design elements to non-game environments [37]. Even though gamification is a relatively new concept, its potential cost-effectiveness, accessibility, and flexibility, as well as the increasing popularity of video games have led to it being applied to a variety of contexts. It has been argued that the core idea behind gamification is to transfer game design elements to non-game environments [37].

received considerable interest from the health research community for its potential to increase engagement with health interventions [9, 33, 55, 61, 80]. However, recent reviews find that gamification is most commonly applied to physical fitness interventions and to motivate behaviour change to manage chronic illnesses, and although some gamified mental health interventions do exist they are much less common [55, 80]. This is because some of the most common gamification elements are points, rewards and leaderboards which are often quite inappropriate for mental health interventions [4, 29]. Many applications of gamification for general health and well-being tend to rely on elements providing positive reinforcement and extrinsic motivation, an approach which is difficult to extend to mental health domains. It is therefore imperative to be able to distinguish between the different game design elements within the concept of gamification, instead of considering it as one generic construct, to make better use of elements that are more compatible with intrinsic motivation and therefore more relevant for mental health applications.

得到了健康研究界的相当大的兴趣,因为它有可能增加对健康干预的参与[9,33,55,61,80]。然而,最近的研究发现,游戏化最常用于身体健康干预和激励行为改变,以管理慢性疾病,尽管一些游戏化的心理健康干预措施确实存在,但它们不太常见[55,80]。这是因为一些最常见的游戏元素是积分、奖励和排行榜,这些往往不适合心理健康干预[4,29]。游戏化对一般健康和福祉的许多应用往往依赖于提供积极强化和外在动机的因素,这种方法很难扩展到心理健康领域。因此,必须能够区分游戏化概念中的不同游戏设计元素,而不是将其视为一种通用构造,以便更好地利用与内在动机更相容的元素,从而更适合于心理健康应用。

Game elements that are well suited to the context of mental health include personalisation and customization. These elements offer the users increased levels of autonomy which contributes to increased internalized motivation and well-being [78]. These elements have been explored in several apps for different mental health contexts, such as in an app for alcohol use disorder [69] and another targeted towards general motivation impairment that increased engagement by allowing users to unlock options for aesthetic customization as they progressed [45].

适合心理健康环境的游戏元素包括个性化和定制化。这些元素为用户提供了更高水平的自主性,这有助于增加内在动机和福祉[78]。这些元素已经在针对不同心理健康背景的几个应用程序中进行了探索,例如针对酒精使用障碍的一个应用程序[69],以及针对一般动机障碍的另一个应用程序,这种障碍通过允许用户在进行审美定制时释放选项来增加参与度[45]。

Narrative and theme are very important game design elements, particularly in the context of this paper, as they are directly linked to the increase of intrinsic motivation [12, 14, 65] making them highly relevant to mental health contexts. Narratives or meaningful stories are elements that do not relate to the user's performance or progress in any way. The narrative context in which the application is embedded contextualizes the activities and characters in the application and therefore gives them meaning beyond point scoring and achievements. The narrative can relate to real, non-game settings or can be designed to be analogous to real world settings, which can enrich otherwise mundane scenarios and increase motivation in users, particularly if the story is in line with their personal

interests [71]. Narratives have been explored in apps designed for acrophobia [38], agoraphobia and panic [31], anxiety and depressive disorders [36, 68, 74], as well as in general well-being apps [58]. Moreover, narratives allow the application to be easily adapted or contextualized to the specific needs of a particular user group in order to better cater to user needs.

叙事和主题是游戏设计中非常重要的元素,特别是在本文中,因为它们与内在动机的增加直接相关[12,14,65],使它们与心理健康背景高度相关。叙述或有意义的故事是与用户的表现或进展无关的元素。应用程序嵌入的叙事语境将应用程序中的活动和特征联系起来,因此赋予它们超越评分和成就的意义。故事可以与真实的非游戏场景相关,也可以设计成与真实世界相似的场景,这可以丰富其他平凡的场景,增加用户的动机,特别是如果故事符合他们的个人兴趣[71]。针对恐高症[38]、广场恐惧症和恐慌症[31]、焦虑症和抑郁症[36,68,74],以及一般的幸福应用程序[58]的应用程序,已经探索了叙事。此外,叙述使应用程序能够容易地适应或上下文化地满足特定用户群体的特定需求,以更好地满足用户需求。

Avatars are also relevant gamification elements which are often used in conjunction with narratives [90]. Whether in the form of a simple pictogram or complex animations, avatars give the users an identity and set them apart from other characters in the application. They also allow the users to adopt or create an identity, which, when used in tandem with elements such as customization, can also contribute to increased autonomy [7].

阿凡达也是相关的游戏化元素,经常与叙事结合使用[90]。无论是以简单的象形图还是复杂的动画形式,阿凡达都给用户一个身份,并将他们与应用程序中的其他字符区分开来。它们还允许用户采用或创建一个标识,当与定制等元素一起使用时,这个标识也可以有助于增加自主性[7]。

A study conducted to examine how individuals use and customize mental health apps to manage their symptoms, found that gamification was perceived as one of the most helpful features

一项研究调查了个人如何使用和定制心理健康应用程序来控制他们的症状,发现游戏化被认为是最有帮助的功能之一

[92]. A review of 50 mobile apps employing gamification for mental health showed that the mode count of gamification elements

一项对 50 个使用游戏化的手机应用程序对男性心理健康的回顾显示,游戏化元素的模式计数

was 5 [28]. While this shows that researchers are now increasingly comfortable applying a range of gamification elements for health and well-being, the decision regarding which game elements to incorporate is often arbitrary and care must be taken to identify which elements can have the desired psychological effect given the application context. 是 5[28]。虽然这表明, 研究人员现在越来越习惯于应用一系列游戏化元素来促进健康和福祉, 但关于应纳入哪些游戏元素的决定往往是武断的, 必须注意鉴定哪些元素在应用背景下可以产生预期的心理效果。

Our application was designed to incorporate particular game design elements, namely narrative and theme, personalization, customization and avatars, on the basis of the psychological effects that were most relevant to our specific mental health context of fostering a therapeutic alliance via engagement and motivation within a mobile application based on CBT.

我们的应用程序旨在结合特定的游戏设计元素, 即叙事和主题、个性化、定制化和化身, 其基础是与我们特定的心理健康背景最相关的心理效应, 即在基于认知行为疗法的移动应用程序中通过参与和动机促进治疗联盟。

2.3 Storytelling

2.3 讲故事

Although the previous section on gamification has also touched upon narratives in the context of game design elements, since storytelling is a central concept in our design we also conducted an additional literature review on the topic.

尽管前面关于游戏化的部分也涉及了游戏设计元素背景下的叙述, 但由于讲故事是我们设计中的一个核心概念, 我们也对这个主题进行了额外的文献回顾。

Storytelling is a powerful learning tool, and has been referred to as the original form of teaching [75]. It is therefore the ideal way to present information in a way that is meaningful, and has often been utilised to deliver educational, social or cultural messages and make abstract and complex concepts more accessible. Stories are vivid, engaging, entertaining and easy to relate to one's personal experience. This leads to them being more memorable, and cognitive science research tells us that memorable information is far more likely to be acted upon and has a greater likelihood of assuming significance [5, 77]. Additionally, due to the rich contextual detail that can be embedded into stories, they are ideal carriers of tacit knowledge [81].

讲故事是一种强大的学习工具, 被称为教学的原始形式[75]。因此, 信息技术是以有意义的方式表达信息的理想方式, 并经常被用来传递教育、社会或文化信息, 使抽象和复杂的概念更容易理解。故事是生动的, 引人入胜的, 娱乐性的, 并且容易与一个人的个人经历联系起来。这使得他们更容易被记住, 而认知科学研究告诉我们, 记住的信息更容易被采取行动, 也更容易被认为具有重要意义[5,77]。此外, 由于可以嵌入故事的丰富的上下文细节, 他们是隐性知识的理想载体 [81]。

When a narrative is particularly immersive, it often results in the perception of being transported right into the fictional or alter-nate world that is being presented. Narrative transportation theory discusses this 'transportation' as a mechanism through which nar-

ratives can strongly affect beliefs [48]. Further work on this elucidates that narratives can effectively influence cognition, emotion and potentially even behaviour [14]. The concept of Narrative Engagement embellishes this idea of immersion and transportation by identifying that people tend to combine information from the text they are reading with personal experiences and construct a mental model of story events which can have a strong impact on attitude and behaviour [24, 25]. Additionally, narratives that present the opportunity to explore possible selves are in a unique position to help drive one's internal motivation [14].

当一个故事特别沉浸其中时, 它通常会导致一种直接进入虚构或另一个呈现的世界的感觉。叙事运输理论将这种“运输”作为叙事者可以强烈影响信仰的一种机制来讨论[48]。进一步的工作阐明了叙述可以有效地影响认知, 情绪甚至潜在的行为[14]。叙事参与的概念通过确定人们倾向于将他们正在阅读的文本中的信息与个人经历结合起来, 并建立一个故事事件的心理模型, 这个模型可以对态度和行为产生强烈的影响, 从而丰富了这种沉浸和交通的概念[24,25]。此外, 提供探索可能的自我的机会的叙述处于一个独特的位置, 有助于驱动人的内在动机[14]。

Digital storytelling, in particular, has even more advantages as it can engage a multitude of cognitive processes by incorporating visual elements as well as allowing audiences to not only be passive recipients but to also interact with and actively shape the stories.

特别是数位说故事更具优势, 因为它可以融合视觉元素, 让观众不仅是被动的接受者, 还可以与故事互动和主动塑造故事。

Therefore, existing literature pertaining to the unique advantages of storytelling make it clear that it can offer a promising medium to optimise the delivery of relevant mental health information and has immense potential to create positive change in this context.

因此, 有关讲故事独特优势的现有文献表明, 讲故事可以提供一個有希望的媒介, 以最佳方式提供相关的精神健康信息, 并具有在这方面产生积极变化的巨大潜力。

3 APPLICATION DESIGN PROCESS

3 应用设计流程

Drawing on our research into psychotherapy, narrative theories, gamification and HCI, we developed a solution in the form of a 基于我们对心理治疗、叙事理论、游戏化和人机交互的研究, 我们开发了一个解决方案

mobile application. The application, called Chronicles, progresses like a role-playing game where users play the main character and find themselves in common scenarios taking place in a college setting. In each scenario, the user is asked to choose from a list of options, what their character is feeling, what their character is thinking, and how their character would like to proceed (Figure 1). Based on their thought choices, they will be presented with immediate feedback in the form of a pop-up screen if their selection corresponds to a cognitive distortion. Their action choices will determine how the story progresses. The application is designed to help users identify cognitive distortions present in their thoughts, to clearly differentiate between rational and irrational automatic thoughts, to understand the link between emotions, thoughts and behaviours, and to provide some insight on how certain situations can be perceived in different ways. The application is based on CBT principles, and various aspects are combined to achieve these outcomes, such as interactive storytelling, visual design, interaction design and specific gamification elements. Chronicles is a fully functional, cross-platform application developed in Unity.

流动应用程序。这个名为 Chronicles 的应用程序进展得就像一个角色扮演游戏，用户扮演主角，发现自己身处大学环境中的常见场景中。在每个场景中，用户被要求从选项列表中选择，他们的角色感觉如何，他们的角色在想什么，以及他们的角色希望如何继续(图 1)。基于他们的思想选择，如果他们的选择与认知扭曲相对应，他们将以弹出式屏幕的形式得到即时反馈。他们的行为选择将决定故事的进展。该应用程序旨在帮助用户识别他们思维中存在的认知扭曲，明确区分理性和非理性的自动思维，理解情绪、思维和行为之间的联系，并提供一些洞察力，说明如何以不同的方式看待某些情况。该应用程序基于认知行为疗法(CBT)原则，并结合各个方面来实现这些结果，如交互式故事讲述、视觉设计、交互设计和特定的游戏化元素。Chronicles 是 Unity 开发的一个功能齐全的跨平台应用程序。

3.1 Storylines

3.1 Storylines 3.1 故事线

3.1.1 User Research. In order to contextualise the storylines and present scenarios that are relevant to the users, we conducted extensive user research to collect stories and gather in depth insights into the different situations students encounter that could induce stress, anxiety or have any adverse effects on their mental health.

3.1.1 用户研究。为了将故事情节和与使用者相关的场景联系起来，我们进行了广泛的用户研究，收集故事，深入了解学生可能遇到的可能引起压力、焦虑或对他们的心理健康有任何不利影响的不同情况。

We worked in close consultation with members of the Psychology department (n=2) as well as on-campus counsellors (n=4) to design a questionnaire asking students to reflect on their experiences at college. The questionnaire was divided into five sections 1) Social Anxiety 2) Academic Stress 3) Identity 4) Future Plans 5) Professional Help. Each section consisted of 5-6 open-ended questions. Due to the sensitive nature of the topic, we took the extra step of circulating the questionnaire via the Office of Student Affairs, proving the credibility of our study to the students as well as assuring them of data security. At the end of the questionnaire, students were asked if they are willing to be interviewed. The purpose of the interviews was to allow participants that had difficulty narrating their experience through a written medium to better convey their thoughts

and experiences. The semi-structured interviews followed a similar structure to the questionnaire, but allowed for students to provide a more detailed recollection of events. On average, each interview lasted between 45-60 minutes.

我们与心理学系的成员(n = 2)以及校园辅导员(n = 4)密切协商，设计了一份问卷，要求学生反思他们在大学的经历。问卷分为五个部分：1)社交焦虑 2)学术压力 3)身份 4)未来计划 5)专业帮助。每个部分包括 5-6 个开放式问题。由于问题的敏感性，我们采取了额外的步骤，通过学生事务办公室传阅问卷，向学生证明我们的研究是可信的，并保证他们的数据安全。在问卷结束时，学生被问及是否愿意接受采访。访谈的目的是让那些有困难的参与者通过书面媒介来叙述他们的经历，以便更好地传达他们的想法和经历。半结构化的采访遵循与问卷相似的结构，但允许学生提供更详细的事件回忆。平均每次面试持续 45-60 分钟。

We received 229 responses to the questionnaire out of which 24 students were then further interviewed. All responses fit our eligibility criteria which entailed that the students must be currently enrolled at Lahore University of Management Sciences (LUMS) and be between the ages of 18-25. The demographic data of the participants who responded to the questionnaire was collected. The sample included representation across gender (57.5% Female, 41% Male, 1.5% Gender-queer/Non-conforming), sexuality (81.3% Heterosexual, 6.7% LGBTQ+, 2.2% Asexual, 3% Questioning, 6.7% Declined to state) socioeconomic status (47.7% average family income of less than 150k (PKR), 52.3% above 150k), geographic region (81.3% Punjab, 11.9% Sindh, 3.7% Khyber Pakhtunkhwa, 3.1% Islamabad Capital Territory) and living situation (17.9% Hostelite, 82.1%.

我们收到了 229 份调查问卷，其中 24 名学生接受了进一步的访谈。所有的答复都符合我们的资格标准，即学生必须是目前在拉合尔管理科学大学(LUMS)注册，年龄在 18-25 岁之间。收集了回答问卷的参与者的人口统计数据。样本包括不同性别的代表性(57.5% 女性，41% 男性，1.5% 性别酷儿/不符合标准)，性别(81.3% 异性恋，6.7% LGBTQ +，2.2% 无性恋，3% 质疑，6.7% 拒绝国家)，社会经济地位(47.7% 平均家庭收入低于 150k (PKR)，52.3% 高于 150k)，地理区域(旁遮普省 81.3%，信德省 11.9%，开伯尔-普赫图赫瓦省 3.7%，伊斯兰堡首都地区 3.1%)和生活状况(17.9% Hostelite，82.1%)

What are you thinking?
你在想什么？

Day Scholar). This heterogeneity among sample characteristics was important for us to ensure a diverse and inclusive range of perspectives and experiences when developing the narratives. The data was then organized, and all audio recordings of interviews were transcribed. We familiarised ourselves with the data by annotating transcripts and then conducted a qualitative thematic analysis [22]. The data was coded and labelled and then further reviewed to generate themes. We arrived at a set of themes such as 'making friends', 'class participation' and 'work-life balance'. This was particularly complex as each story contained a number of different but equally relevant codes. For example, one story involved a participant feeling overburdened by academic work and consequently feeling guilty about not spending enough time with friends and his friendships suffering as a result. This took a mental toll on him leading to even poorer academic performance. Some of the codes here were 'academic pressure', 'social pressure', 'guilt', 'fear of missing out', but the story was categorised under the 'work-life balance' theme.

戴学者)。样本特征之间的这种异质性对于我们在开发叙述时确保多样化和包容性的视角和经验很重要。然后组织数据，并转录所有访谈的录音。我们通过注释成绩单来熟悉数据，然后进行定性主题分析[22]。数据被编码和标记，然后进一步审查以生成主题。我们达成了一系列主题，如“交朋友”，“课堂参与”和“工作-生活平衡”。这是特别复杂的，因为每个故事都包含了许多不同但同样相关的代码。例如，一个故事涉及一个参与者感到学术工作负担过重，因而对没有花足够的时间与朋友在一起而感到内疚，结果他的友谊受到了损害。这给他带来了精神上的负担，导致他的学习成绩更差。这里的一些代码是“academic pressure”、“social pressure”、“guilt”、“fear of missing out”，但这个故事被归类为“work-life balance”这个主题。

These themes and insights derived from the questionnaire and interviews formed the basis of our narratives. The stories were adapted and generalized enough to not point to a specific reported story.

这些来自调查问卷和访谈的主题和见解构成了我们叙述的基础。这些故事经过了足够的改编和概括，以至于没有指向特定的报道故事。

3.1.2 Narrative Construction. The application consists of 4 levels representing a typical undergraduate program with each level corresponding to an academic year (Freshman, Sophomore, Junior, Senior). Each level has 5 'chapters' with individual subplots, linked together by the same central character played by the user. The narratives are told in first person in order to develop a connection between the user and character, increase immersion, personal relevance and absorption power. The user advances through the narrative by making various choices that determine how the story progresses and the kind of feedback that is provided. In order to maintain logical consistency and increase realism, as these factors are linked to a reader's enjoyment of a narrative, the information provided in earlier chapters remains relevant in the subsequent chapters. The individual plots of the chapters themselves are based on the key themes that were identified through user research.

3.1.2 叙事结构。该应用程序包括 4 个级别，代表一个典型的本科项目，每个级别对应于一个学年(新生，二年级，大三，大四)。每个级别有 5 个“章节”，每个子情节由用户扮演的同一个中心角色连接在一起。故事以第一人称讲述，以发展用户和角色之间的联系，增加沉浸

感，个人相关性和吸收力。用户通过做出各种选择来决定故事的进展和提供的反馈。为了保持逻辑上的一致性和增加现实性，因为这些因素与读者对叙述的享受有关，前几章提供的信息在后几章仍然是相关的。章节本身的个别情节是基于通过用户研究确定的关键主题。

The subplots within each chapter follow a similar structure using the Cognitive Appraisal Model (Figure 2) as a framework. This model is based on the principles of CBT, and posits that emotional distress such as stress and anxiety and behavioural reactions that are accompanied by unintended consequences are typically the result of inaccurate or unhelpful appraisals. More simply, the way someone interprets any situation or event has an impact on how they feel and what they do. These interpretations or appraisals are then also unknowingly reinforced by these emotional and behavioural reactions. Therefore it is important to understand the appraisals, and this is what we aim to shed light on through our narratives. The appraisal model (Situation-Appraisal-Emotion/Behaviour) provides a helpful format to explore the contribution of meaning to a person's individual experience of an event.

每个章节的子情节遵循一个类似的结构使用认知评估模型(图 2)作为一个框架。这个模型以认知行为疗法的原则为基础，并假定压力、焦虑和伴随意外后果的行为反应等情绪困扰通常是不准确或无益评估的结果。更简单地说，人们解释任何情况或事件的方式都会影响他们的感受和行为。这些解释或评价也在不知不觉中被这些情绪和行为反应所加强。因此，理解这些评价是很重要的，这也是我们希望通过我们的叙述来阐明的。评价模型(情境-评价-情绪/行为)提供了一个有用的形式来探索意义对一个人对一个事件的个人经验的贡献。

Each narrative therefore places the protagonist, played by the user, into a situation or event they are likely to encounter at university. They are then presented with a trigger, which can be some change in the external situation or environment or something the character notices. Following the trigger, the user is asked to choose which emotion the character is feeling (Figure 1). The list of options

因此，每个故事都将主人公(由用户扮演)置于他们在大学可能遇到的情境或事件中。然后他们会被呈现出一个触发点，这个触发点可能是外部环境或者角色注意到的某些变化。在触发之后，用户被要求选择角色感受到的情绪(图 1)。选项列表

Woodstock '18, June 03-05, 2018, Woodstock, NY
Woodstock'18, June 03-05,2018, Woodstock, NY
伍德斯托克 2018 年 6 月 3 日至 5 日, 纽约

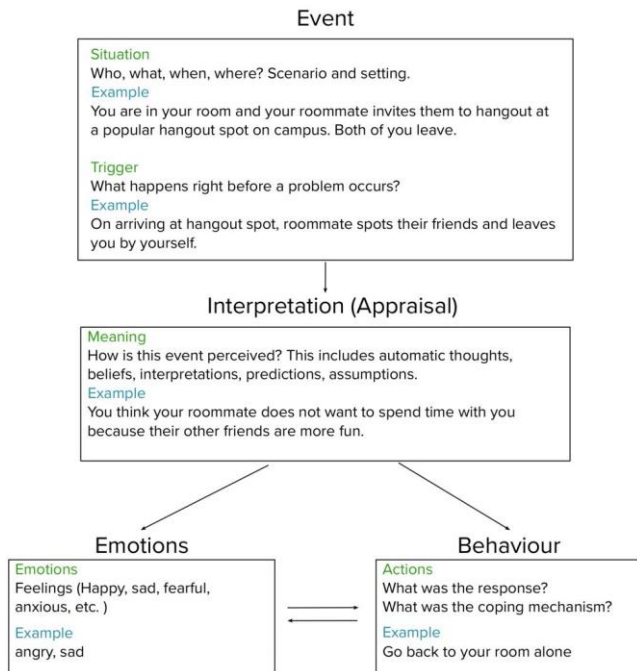


Figure 2: Cognitive Appraisal Model
图 2: 认知评估模型

presented here comprises the five basic categories of emotions; joy, fear, anger, disgust and sadness. Within each category, we present 2-3 different variations of emotional experiences such as 'Happy' and 'Excited' within the core emotion category of 'Joy'. Immediately after this they are asked what the character is thinking; how is this event perceived or appraised? The list of 7 options provided at this stage include rational and neutral thoughts as well as irrational thoughts, of which the irrational thoughts are mapped onto corresponding cognitive distortions. If the user's choice reflects any cognitive distortion they are presented with a pop-up screen containing the name of the distortion and a short explanation. Following this, the user is asked how they wish the character to proceed. Depending on the context of the story, they could choose from a list of 2-3 dialogues or actions. By repeatedly going through this process for several chapters, the user can begin to see a pattern of cognitive distortions in their thoughts and better understand the link between feelings, thoughts and behaviours.

这里展示的情绪包括五个基本类别：喜悦，恐惧，愤怒，厌恶和悲伤。在每个类别中，我们呈现 2-3 种不同的情感体验，例如“快乐”和“兴奋”在“快乐”的核心情感类别中。紧接着，他们被问到这个角色在想什么；这个事件是如何被感知或评价的？这个阶段提供的 7 种选择包括理性和中性思维以及非理性思维，其中非理性思维被映射到相应的认知扭曲上。如果用户的选择反映了任何认知扭曲，他们会看到一个弹出屏幕，其中包含扭曲的名称和一个简短的解释。接下来，用户会被问到他们希望角色如何继续。根据故事的上下文，他们可以从 2-3 个对话或动作列表中进行选择。通过在几章中反复地经历这个过程，用户可以开始看到他们思想中的认知扭曲模式，并且更好地理解感觉、思想和行为之间的联系。

Figure 2 shows a sample narrative from our application that has been mapped on to the Cognitive Appraisal Model to better illustrate our framework and process. This narrative revolves around the theme of social anxiety. Through the data gathered during our user research, we saw that most social gatherings took place at a popular student hangout spot on campus commonly referred to as the khoka which would literally translate to 'local neighbourhood kiosk' in English. The khoka was therefore our chosen setting for this narrative. The initial situation presented in this narrative is that the protagonist, played by the user is at the khoka with a friend. The trigger occurs when the friend notices a group of people they know and goes of to chat with them, leaving the main character standing by themselves. At this point, we need to see how the user

图 2 显示了我们的应用程序的一个示例说明，该示例说明已经映射到认知评估模型，以便更好地描述我们的框架和过程。这个故事围绕着社交焦虑这个主题展开。通过我们在用户研究中收集的数据，我们发现大多数社交聚会都是在校园里一个很受欢迎的学生聚会地点举行的，这个地方通常被称为 khoka，在英语中它的字面意思就是“本地邻居小亭”。因此我们选择 khoka 作为这个故事的背景。这个故事最初呈现的情景是主人公，由用户扮演，和一个朋友在 khoka。当朋友注意到一群他们认识的人，然后去和他们聊天，让主角独自站着时，触发点就出现了。在这一点上，我们需要看看用户是如何

has interpreted this event and this is done by asking them what the character is feeling and thinking. After the appraisal, the user then decides what action to take which influences how the story progresses and how the chapter concludes.

通过询问他们角色的感受和想法来解释这个事件。在评估之后, 用户决定采取什么样的行动来影响故事的进展和章节的结尾。

3.2 Visual Design

3.2 可视化设计

The visual design of the application was also an important factor in increasing engagement with the storylines and delivering information in a more impactful way. Contextualising the visual design was also a means to creating a connection between the user and the application and increasing personal relevance and immersion. We took an iterative approach to the visual design, relying on research to inform our initial decisions and user testing to improve further versions of our design.

应用程序的视觉设计也是增加与故事情节的接触和以更有影响力的方式传递信息的一个重要因素。视觉设计的背景化也是在用户和应用程序之间建立联系, 增加个人相关性和沉浸感的一种手段。我们对视觉设计采取了一种迭代的方法, 依靠研究来告知我们最初的决定和用户测试来改进我们设计的进一步版本。



Figure 3: Left: Actual 'Khoka' Center: 'Khoka' from First Iteration Right: 'Khoka' from Final Iteration
图 3: 左: 实际 'Khoka' 中心: 'Khoka' 来自 First Iteration Right: 'Khoka' 来自 Final Iteration

To complement the contextualised narratives, the landscapes were set in the college campus. Initially, we took the main landmarks of our campus and portrayed them through a fantastical visual language using an exaggeration of natural elements such as trees and mountains. The rationale for this was based on literature that suggests fantasy has been a factor in facilitating active engagement

为了补充情境化的叙述, 景观设置在大学校园。最初, 我们选取了我们校园的主要地标, 并通过一种奇妙的视觉语言, 使用树木和山脉等自然元素的夸张来描绘它们。这样做的基本原理是建立在文学基础上的, 文学认为幻想是促进积极参与的一个因素

[73] and is a source of intrinsic motivation [13, 62]. We wanted to achieve a balance between realism and fantasy, catering to our need for contextualisation as well as engagement and immersion. 并且是内在动机的来源[13,62]。我们希望在现实主义和幻想之间实现平衡, 满足我们对情境化以及参与和沉浸的需求。

Moreover, we ensured consistency in the UI elements for the three main decision making interactions; where users are asked to choose an emotion, a thought and an action. This was done to create a visual link that could also help users understand the connection between feelings, thoughts and behaviours (Figure 1). The colour palette for the UI elements was also chosen to



Figure 4: Top Left: Actual 'SSE' Top Right: 'SSE' in app Bot-
图 4: 左上角: 实际的 'SSE' 右上角: app Bot 中的 'SSE'
tom Left: Actual 'Library' Bottom Right: 'Library' in app
Tom Left: Actual 'Library' Bottom Right: 应用程序中的 'Library'

complement the realistic colours of the landscape, keeping in mind literature that shows certain colours have effects on thoughts and emotions as it was imperative to ensure our visual design did not evoke any emotion that could influence the user's interpretation of events presented in the narratives.

此外, 我们确保了三个主要决策交互的用户界面元素的一致性; 在这三个主要决策交互中, 用户被要求选择一种情绪、一个想法和一个行动。这样做是为了创建一个视觉链接, 也可以帮助用户理解感觉, 思想和行为之间的联系(图 1)。用户界面元素的色彩调色板也被选择来补充景观的现实主义色彩, 记住文学显示某些颜色对思想和情感有影响, 因为它必须确保我们的视觉设计不会引起任何情感, 可能会影响使用者对叙述中呈现的事件的解释。

3.2.1 User Feedback. We tested this first iteration with a group of ten students who had also participated in our narrative user research. We found that the fantastical setting seemed to contribute to a feeling of disconnect with the narratives, as the relatability was diminished (Figure 3: Center). Hence, acting on these insights we modified our visual language and took care to use very subtle fantastical elements such as dense forests in the distance or lone trees growing in indoor spaces while maintaining the realism in the built environment (Figure 3: Right). Overall, the whole process of designing and testing the visual landscapes took around eight months, with each landscape taking an average of two to three days to complete.

3.2.1 用户反馈。我们对第一个迭代进行了测试, 有 10 名学生参与了我们的叙事用户研究。我们发现, 幻想的设置似乎有助于与叙事脱节的感觉, 因为相关性减少(图 3: 中心)。因此, 基于这些见解, 我们修改了我们的视觉语言, 并注意使用非常微妙的幻想元素, 如远处茂密的森林或在室内空间生长的孤独的树木, 同时在建筑环境中保持现实主义(图 3: 右)。总的来说, 设计和测试视

觉景观的整个过程大约需要八个月，每个景观平均需要两到三天才能完成。

3.3 Avatars

3.3 个阿凡达

Avatars are important gamification elements that can complement narratives and foster a connection between users and the application by allowing them to create or adopt an identity. Combining this with another gamification element of customization can greatly contribute to a sense of increased autonomy [7]. Similar to the visual design process, we developed initial iterations based on research and then developed further iterations based on user feedback.

阿凡达是重要的游戏元素，可以补充叙事，并通过允许用户创建或采用一个身份，促进用户和应用程序之间的联系。将这与另一个定制的游戏化元素相结合，可以大大有助于增加自主性[7]。与视觉设计过程类似，我们基于研究开发了初始迭代，然后基于用户反馈开发了进一步的迭代。

For the design of the avatar that would represent the playable main character, we wanted to create a basic 'shell' which the user could project themselves onto without assigning too many complex elements. The visual language we adopted led us to design avatars with exaggerated body shapes. This was, again, an attempt to insert a fantastical element into the design. The user was given several customization options for hairstyles, skin tone, clothes and shoes. We took care to have an inclusive range of options for clothing, incorporating western as well as eastern styles of dress, and not creating any distinction within customization options based on gender. All the options were designed within our colour palette range, so that they would not clash with the visual design of any of the landscapes they would be placed in.

为了设计代表可玩主角的化身，我们希望创建一个基本的“shell”，用户可以投射到上面，而不需要分配太多复杂的元素。我们采用的视觉语言引导我们设计具有夸张身体形状的虚拟形象。这再一次尝试在设计中插入一个奇妙的元素。用户可以选择几种自定义的发型、肤色、衣服和鞋子。我们小心翼翼地为服装提供了一系列包容性的选择，融合了西方和东方的服装风格，并且没有在基于性别的定制选项中进行任何区分。所有的选项都是在我们的调色板范围内设计的，以便他们不会冲突的视觉设计的任何景观，他们将被置于。

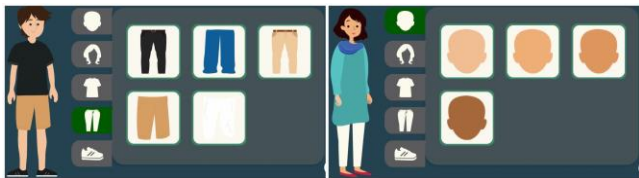


Figure 5: Character Customization
图 5: 角色定制

3.3.1 User Feedback. From the user feedback obtained from the same ten students, we gained insights into the shape of the avatars. The exaggerated body shape was not perceived well, as it appeared to be an idealistic body type with its elongated legs and shortened torso. In further iterations, therefore, we decided on an amorphous form for the bodies of the avatars in order to avoid any negative impacts from unrealistic body shapes or lack of body diversity representation.

3.3.1 用户反馈。从这 10 个学生的用户反馈中，我们得到了阿凡达形状的深刻见解。夸张的身体形状没有被很好的理解，因为它

看起来是一个理想化的身体类型，有着细长的腿和短小的躯干。因此，在进一步的迭代中，我们为阿凡达的身体决定了一种无定形的形式，以避免不切实际的身体形状或缺乏身体多样性表示的任何负面影响。

What are you thinking?
你在想什么？

3.4 Interaction Mechanics

3.4 相互作用力学

The interaction mechanics within Chronicles were designed with the objective of facilitating interaction between the user and the application, increasing engagement and motivation and hence emulating a therapeutic alliance within the digital intervention. To make the narrative interactive, we made use of decision making at three stages within each chapter; feelings, thoughts and actions. This mechanism of decision making not only serves to make the narratives more interactive and engaging, but also shows the user that there are several alternative ways of thinking about a single scenario. While selecting the option that would match their own thoughts, they would also be making the connection between their own feelings, thoughts and behaviours. Decision-making is also suitable in the context of learning, and can therefore also facilitate the psychoeducational component of the application.

Chronicles 中的交互机制旨在促进用户和应用程序之间的交互，增加参与度和动机，从而在数字干预中实现治疗联盟。为了使叙述具有交互性，我们在每一章中使用了三个阶段的决策：感觉，思想和行动。这种决策机制不仅有助于使叙述更具互动性和吸引力，而且还向用户表明，对于单个场景，有多种不同的思考方式。在选择符合他们自己想法的选项时，他们也会将自己的感受、想法和行为联系起来。决策也适用于学习的背景，因此也可以促进心理教育的组成部分的应用。

As mentioned previously, the application is divided into four levels, corresponding to the four years of a typical undergraduate degree; Freshman, Sophomore, Junior, Senior. Each level has five chapters each comprised of a different scenario, and at the end of each level the user is presented with a short summary of their 'year' based on the choices they made. This also serves to enhance engagement by increasing the user's sense of agency and personal relevance of the content. A progress bar was also added at the top of the screen for better user experience and so that it may also motivate users to complete the level they are on.

如前所述，申请分为四个等级，对应于一个典型的本科学位的四年：大一，大二，大三，大四。每个级别有五个章节，每个章节由一个不同的场景组成，在每个级别的最后，用户会根据他们所做的选择得到一个简短的“年”摘要。这也有助于提高用户的参与度，增强用户的代理意识和内容的个人相关性。屏幕顶部还添加了一个进度条，以提供更好的用户体验，这样也可以激励用户完成他们所处的级别。

In order to enhance the connection between the user and the virtual environment and increase immersion, we also incorporated dynamic elements within our landscapes. This was done through animating certain objects such as the trees and natural elements in the background, so that they would gently sway from side to side. The movement was kept minimal, so as to not create a jarring impact that could have the counter-productive effect of snapping the users back to reality. Additionally, the landscapes were designed in a layered manner, to give rise to a depth effect if the user pans to the right or left of the landscape. At this time, there was no aural element within the application, although we do intend to incorporate that in future iterations as audio can play a significant role in immersion and engagement.

为了加强用户和虚拟环境之间的联系，增加沉浸感，我们还在景观中加入了动态元素。这是通过动画特定的对象来实现的，比如背景中的树木和自然元素，这样它们就可以轻轻地从一边摇摆到另一边。

移动被保持在最小，以免产生不和谐的影响，可能会产生反效果，让用户回到现实。此外，景观设计在一个分层的方式，以产生深度效应，如果使用者平移到右侧或左侧的景观。此时，应用程序中没有听觉元素，尽管我们确实打算在未来的迭代中加入这些元素，因为音频可以在沉浸和参与中发挥重要作用。

3.5 Usability Testing

3.5 可用性测试

Once we had developed a high fidelity prototype of our application, we conducted initial usability testing to determine the extent to which our application met the needs of our target population and to get feedback on the overall design. We recruited 50 students via the Ofce of Student Affairs who met the eligibility criteria that they must be currently enrolled at LUMS and be between the ages of 18-25. Each participant was allotted a one hour time slot in which they were frst given the prototype of our application and were asked to complete the first level of the game. After completion, participants filled out the System Usability Scale (SUS) and took part in a semi-structured interview in which they talked about their experience using the application, particularly focusing on which elements of the application contributed to higher engagement and motivation.

一旦我们开发了应用程序的高精度原型，我们就进行了初始的可用性测试，以确定我们的应用程序在多大程度上满足了目标人群的需求，并获得关于总体设计的反馈。我们通过学生事务办公室招募了 50 名符合资格标准的学生，他们目前必须在 LUMS 注册，年龄在 18-25 岁之间。每个参与者都被分配了一个小时的时间段，在这个时间段里，他们首先被给予我们应用程序的原型，然后被要求完成游戏的第一关。完成后，参与者填写了系统可用性量表 (SUS)，并参加了一个半结构化的访谈，在访谈中，他们谈论了他们使用该应用程序的经验，特别是应用程序的哪些元素有助于提高参与度和动机。

Overall, participants were satisfied with the usability of the application with the average SUS score being 83.8%. The main finding

总的来说，参与者对应用程序的可用性表示满意，SUS 平均得分为 83.8%

from this round of testing was that 100% of the participants found the narratives highly relatable. Furthermore, 100% of the participants also commented on how the familiar landscapes helped keep them engaged in the stories. Both points highlight how users felt that the contextualization of content contributed to the engagement with the application. 在这一轮测试中, 100% 的参与者认为这些叙述是高度相关的。此外, 100% 的参与者还评论了熟悉的风景如何帮助他们参与故事。这两点都强调了用户是如何感受到内容的上下文化背景有助于与应用程序的互动。

4 RANDOMIZED CONTROLLED TRIAL 随机对照试验

The purpose of this study was to examine the effect of combining interactive storytelling and CBT in a gamified mHealth application. Furthermore, we aimed to explore this effect in comparison to existing self-guided CBT apps to assess whether our approach could improve the efficacy of these interventions. In order to do this, we designed and conducted a 3-arm randomized controlled trial in which participants used our application, an existing mHealth CBT app, or were assigned to a waitlist group. The LUMS Institutional Review Board approved all procedures.

本研究的目的在于探讨在游戏化的移动健康应用程序中结合交互式讲故事和认知行为疗法的效果。此外, 我们旨在探索这种效应与现有的自我引导 CBT 应用程序相比较, 以评估我们的方法是否可以提高这些干预措施的效果。为了做到这一点, 我们设计并进行了一个三臂随机对照试验, 其中参与者使用我们的应用程序, 一个现有的移动健康认知行为疗法应用程序, 或被分配到等待名单组。LUMS 机构审查委员会批准了所有程序。

4.1 Study Design 4.1 研究设计

A mixed factorial 3(condition) x 2(time) repeated measures design was applied. Participants were randomly assigned to one of three groups: test, control or waitlist. The trial duration was 2 weeks and the measures were conducted at the beginning (t1) and again at the end (t2).

采用混合因子 3(条件) x 2(时间)重复测度设计。参与者被随机分配到三组中的一组: 测试, 对照或等待名单。试验持续时间为 2 周, 在开始时(t1)和结束时(t2)进行测量。

4.2 Measures 4.2 措施

4.2.1 Primary Measures.

4.2.1 基本措施。

- Depression: The degree and severity of each participant's depression was assessed before and after the intervention. This was done using the PHQ-9 questionnaire, which is a self-reporting tool that is used for screening, monitoring, diagnosing and measuring the severity of an individual's depression [64]. It objectively determines severity of initial symptoms, and also monitors symptom changes and treatment effects over time.

抑郁: 在干预前后评估每个参与者抑郁的程度和严重程度。这是使用 phq-9 问卷, 这是一个自我报告的工具, 用于筛查, 监测, 诊断和衡量个人的抑郁症的严重程度[64]。它客观地确定了初始症状的严重程度, 并随着时间的推移监测症状变化和治疗效果。

- Anxiety: The degree and severity of each participant's anxiety was assessed before and after the intervention. This was done using the GAD-7 questionnaire, which is a self-reporting tool that is used for screening the most common anxiety disorders [82].

焦虑: 在干预前后评估每个参与者的焦虑程度和严重程度。这是使用 gad-7 问卷, 这是一个自我报告工具, 用于筛选最常见的焦虑障碍[82]。

4.2.2 Secondary Measures.

4.2.2 次要措施。

- Negative Automatic Thoughts: According to the Cognitive Behavioural Model, negative automatic thoughts directly correlate to the pathogenesis and severity of depression and anxiety. The frequency of occurrence of automatic negative thoughts and the degree of belief held in each was measured for each participant, before and after the intervention. This was done using the ATQ-30 questionnaire [53]. This self-reporting tool presents 30 negative statements and participants indicate how often they experienced the negative thought during the course of the week on a Likert scale of 1–5 (1=Low-High=5).

消极自动思维: 根据认知行为模型, 消极自动思维与抑郁和焦虑的发病机制和严重程度直接相关。在干预之前和之后, 测量每个参与者自动消极思想的发生频率和每个参与者的信念程度。这是使用 atq-30 问卷[53]完成的。这个自我报告工具提供了 30 个消极的陈述, 参与者以 1-5(1 = 低-高 = 5)的 Likert 量表显示他们在一周中经历消极想法的频率。

- Perception and Learning: One of the objectives of our game was to educate users about different cognitive distortions and equip them with the skills to identify when an

感知和学习: 我们游戏的目标之一是教育用户不同的认知扭曲, 并让他们掌握识别

automatic thought is rational or irrational and allow them to understand how their perception of a situation can differ from the reality of the situation itself. This was done through the interactive storylines and choices presented to the users throughout the application, as described in the application design section. In order to assess whether the participants were able to retain and internalize the concepts they learned, we designed a test consisting of six different scenarios similar to the ones in the application, where a protagonist is presented with some kind of trigger and has some thought as a reaction. Of the six scenarios, five represented some kind of cognitive distortion in the protagonist's thought and one represented a neutral thought and a rational appraisal of the situation. The participants were then asked to identify

无意识的思考是理性的或非理性的, 并且允许他们理解他们对一种情况的感知是如何与现实情况本身不同的。这是通过交互式的情节和整个应用程序中呈现给用户的选择来实现的, 如应用程序设计部分所描述的。为了评估参与者是否能够记住和内化他们所学到的概念, 我们设计了一个测试, 由六种不同的情景组成, 类似于应用程序中的情景, 在这些情景中, 主角被呈现出某种触发因素, 并有一些想法作为一种反应。在这六个场景中, 五个场景代表了主人公思想中的某种认知扭曲, 一个场景代表了一种中立的思想和对场景的理性评价。然后参与者被要求辨认

1) whether the thought was rational or irrational, 2) if it was irrational, which cognitive distortion did it display and 3) an explanation for the preceding two answers. For (2) they were given a complete list of cognitive distortions to choose from. No such cognitive distortions were represented that were not present in the application itself. If the participant answered both questions correctly they were given 2 points, if they correctly identified whether a thought was rational or irrational but failed to correctly identify the specific cognitive distortion they were given 1 point, and if they failed to do either they were given 0 points. Two versions of this test were created so that the participant's perception and learning were tested both at the start and the end of the trial. The results from this test contributed to our quantitative and qualitative findings.

1)这个想法是理性的还是非理性的; 2)这个想法是否非理性的; 这个想法显示了什么样的认知扭曲; 3)对前两个答案的解释。因为(2)他们得到了一个完整的认知扭曲列表, 可以选择。这样的认知扭曲在应用程序本身中并不存在。如果参与者正确地回答了这两个问题, 他们将得到 2 分, 如果他们正确地识别了一个想法是理性的还是非理性的, 但没有正确地识别出特定的认知扭曲, 他们将得到 1 分, 如果他们没有任何一个, 他们将得到 0 分。这个测试的两个版本被创建, 以便参与者的知觉和学习在试验的开始和结束都被测试。这个测试的结果有助于我们的定量和定性结果。

- Daily Diary: All participants were also asked to maintain a daily diary throughout the trial duration, highlighting the most significant event that happened each day and their overall thoughts and feelings. The data collected from

this was not used to contribute to our quantitative or qualitative measures, but rather just to ensure the participants were not dealing with any extenuating circumstances that could impact their scores. In the case of a particularly adverse event being reported, the participant would be referred to the on-campus counsellors who we collaborated with for this research.

每日日记: 所有参与者还被要求在整个试验期间保持每日日记, 强调每天发生的最重要事件以及他们的整体思想和感受。从中收集的数据不是用来帮助我们进行定量或定性的测量, 而只是为了确保参与者没有处理任何可能影响他们分数的情有可原的情况。在报告特别不利事件的情况下, 参与者将被转介给我们合作进行这项研究的校园辅导员。

4.3 Interventions

4.3 干预措施

4.3.1 Test Group Intervention. The test group was asked to download our free app, Chronicles, from Google Playstore. The app was intended to be used over a 2-week period. The group was instructed to spend around 5-10 minutes on the application per day.

4.3.1 测试小组干预。测试组被要求从 Google Playstore 下载我们的免费应用程序 Chronicles。这款应用程序的使用时间为两周。该小组被要求每天花 5-10 分钟使用这款应用程序。

4.3.2 Control Group Intervention. One of the aims of our study was to compare the efficacy of our application with the majority of existing mHealth apps delivering CBT, in terms of evidence based therapeutic elements that are reflective of the core competencies of CBT theory. For this reason, we chose CBT Thought Diary as our control group intervention. This application also provided us the benefit of using the same vocabulary and terminology as Chronicles, making the comparison more viable. CBT Thought Diary has been developed by MoodTools and is available for download on all major app platforms. It comprises a psychoeducation module as well as

4.3.2 对照组干预。我们研究的目的之一是比较我们的应用程序与大多数现有的提供认知行为疗法的移动健康应用程序在基于证据的治疗要素方面的效果, 这些要素反映了认知行为疗法理论的核心能力。出于这个原因, 我们选择 CBT 思想日记作为我们的对照组干预。这个应用程序还为我们提供了使用与 Chronicles 相同的词汇和术语的优势, 使得比较更加可行。CBT Thought Diary 是由 MoodTools 开发的, 可以在所有主流应用平台下载。它包括一个心理教育模块以及

an interactive thought record for cognitive restructuring. It was therefore an ideal control intervention, as it too educates users about the various cognitive distortions and allows them to identify their own negative thinking patterns. In order to reduce variables, this group was also instructed to spend around 5-10 minutes on the application per day.

用于认知重建的交互式思维记录。因此，它是一个理想的控制干预，因为它也教育使用者认识各种认知扭曲，并允许他们确定自己的消极思维模式。为了减少变量，这个小组还被指示每天花 5-10 分钟在应用程序上。

4.3.3 Waitlist Group. The waitlist group received no intervention, but completed all the questionnaires and measures at the same times as the test and control groups. Along with the test and control group, the waitlist group was also made to fill out a daily diary. At the end of the trial, the participants in this group also received the Chronicles app.

4.3.3 Waitlist Group. 候补组没有接受干预，但与测试组和对照组同时完成了所有的问卷和测量。除了测试组和对照组，候补组也被要求每天写日记。在试验结束时，该组的参与者还收到了 Chronicles 应用程序。

4.4 Participants and Procedures

4.4 参加者及程序

In order to recruit participants a questionnaire was sent out asking for basic demographic information and further contact information for those willing to participate in the longitudinal research study. As before, the questionnaire was sent out via the Ofce of Student Affairs so that students would be reassured of the credibility of our study as well as the security of their data. We received 177 responses out of which 60 students (53.3% male, 46.6% female) were selected to participate in a longitudinal study as they ft the eligibility criteria of being willing to participate, between the ages of 18 and 25, currently enrolled in the college, and not currently in therapy or on any medication for depression or anxiety. These 60 students were then randomly assigned to one of the three intervention groups, resulting in 20 participants in each group.

为了招募参与者，发出了一份问卷，要求为那些愿意参加纵向研究的人提供基本的人口统计信息和进一步的联系信息。和以前一样，问卷是通过学生事务办公室发出的，这样学生就可以放心，我们的研究的可信度以及他们的数据的安全性。我们收到了 177 份回复，其中 60 名学生(男性占 53.3%，女性占 46.6%)被选择参加追踪研究，因为他们符合参加追踪研究的资格标准，年龄在 18 到 25 岁之间，目前在大学就读，目前没有接受治疗或任何治疗抑郁或焦虑的药物治疗。然后，这 60 名学生被随机分配到三个干预组中的一个，每组有 20 名参与者。

At the beginning of the study, the participants were sent links to the questionnaires as well as download instructions for the apps for the test and control groups. During the trial period, participants in the test and control groups were sent reminders every other day via email to spend approximately 5-10 minutes on the Chronicles app and CBT Thought Diary app respectively. At the end of the two-week period, participants in all three groups were sent the final round of questionnaires as well as an additional exit survey with open-ended questions for them to reflect on their experience with their respective interventions. Due to the large sample size and the

limitations incurred by the current pandemic (Covid-19), we decided to use this survey to collect detailed qualitative insights from each participant rather than conducting interviews for a fraction of the participants.

在研究开始时，参与者被发送到调查问卷的链接，以及测试组和对照组应用程序的下载说明。在试验期间，测试组和对照组的参与者每隔一天通过电子邮件发送提醒信息，分别在 Chronicles 应用程序和 CBT Thought Diary 应用程序上花费大约 5-10 分钟。在两周期结束时，向所有三个小组的参与者发送了最后一轮调查问卷以及附有开放式问题的额外离职调查，供他们反思各自干预措施的经验。由于大样本量和当前流行病(2019 冠状病毒疾病)带来的局限性，我们决定利用这次调查从每个参与者那里收集详细的定性见解，而不是对一小部分参与者进行访谈。

4.5 Data Analysis

4.5 数据分析

To evaluate whether each intervention had a significant effect on each of the four measures (depression, anxiety, automatic thoughts, perception and learning), paired sample t-tests were conducted for measures at t1 and t2, and effect sizes (Cohen's d) were calculated for significant t-values. These results are summarised in Table 2. To compare the changes in each measure between the three different groups, a One-Way ANOVA test was used. This established whether there was a significant difference between the impacts of the three different intervention conditions. If the results of the ANOVA showed a significant difference, a post hoc Tukey's HSD test was performed for pairwise comparisons to determine which intervention was the main driver of this difference. These results

为了评价各种干预措施是否对抑郁、焦虑、自动思维、知觉和学习四项指标均有显著影响，在 t1 和 t2 进行配对样本 t 检验，计算显著 t 值的效应大小(Cohen's d)。这些结果总结在表 2 中。为了比较三个不同组之间每个测量值的变化，使用单因素方差分析检验。这确定了三种不同干预条件的影响是否存在显著差异。如果方差分析结果显示有显著性差异，则进行事后 Tukey's HSD 检验进行配对比较，以确定哪种干预是造成这种差异的主要驱动因素。这些结果

What are you thinking?
你在想什么？

Table 1: Results of t-tests between participants' scores for all measures at t1

表 1: t1 时所有措施参与者得分之间的 t 检验结果

| Measure 措施 | Test:Control (t1) 测试: 控制 (t1) | | Test:Waitlis t (t1) 测试: Waitlist (t1) | | Control:Waitli st (t1) Control: Waitlist (t1) | |
|-----------------------|--|----------|--|----------|--|----------|
| | t- | p- | t- | p- | t-value | p- |
| | value | value | value | value | t-value | value |
| | T 值 | P 值 | T 值 | P 值 | T 值 | P 值 |
| Depressi on 抑郁症 | 1.316 | 0.098102 | 1.376 | 0.088364 | 0.058 | 0.477194 |
| Anxiety 焦虑 | 0.934 | 0.178182 | 1.482 | 0.073343 | 0.556 | 0.290756 |
| NAT NAT | 1.058 | 0.148403 | 1.242 | 0.110861 | 0.184 | 0.427532 |
| Perceptio n 知觉 | 0.455 | 0.325936 | 1.975 | 0.027794 | 1.619 | 0.056912 |

are summarised in Table 3. Across all tests, a p-value of less than 0.05 was considered statistically significant. 在所有测试中，p 值小于 0.05 被认为具有统计学意义。

5 RESULTS

5 结果

In this section, we present both the quantitative and qualitative results of our study. 在本节中，我们介绍了我们研究的定量和定性结果。

5.1 Initial Scores

5.1 初始分数

Though all participants were randomly assigned to one of the three groups (test, control, waitlist) paired sample t-tests for independent means were conducted to ensure there was no significant difference between the participants' scores for all measures at the start of the experiment (t1). 虽然所有的参与者被随机分配到三个组中的一个(测试，控制，候补名单)，配对样本 t 检验的独立方法进行，以确保参与者之间没有显著差异的所有措施的分在实验开始时(t1)。

The results (Table 1) showed that there was no significant difference in scores for all four measures between the test group and the control group, nor between the control group and the waitlist group. Between the test group and the waitlist group, there was no significant difference in scores for Depression, Anxiety or Negative Automatic Thoughts, although there was a significant difference in scores for Perception and Learning. This was factored in during the analysis of the results.

结果(表 1)：试验组与对照组之间、对照组与候补组之间四项指标的得分均无显著性差异。实验组和候补组在抑郁、焦虑和消极

自动思维方面的得分没有显著差异，但在知觉和学习方面的得分有显著差异。在分析结果时考虑到了这一点。

5.2 Within Interventions

5.2 在干预内

To evaluate the effect of each of the three interventions (Chronicles app, CBT Thought Diary, No Intervention) on each of the four measures (depression, anxiety, automatic thoughts, perception and learning), paired sample t-tests (one-tailed) were conducted for each measure at t1 and t2. The results are summarised in Table 2. 为评价三种干预措施(Chronicles app、CBT 思维日记、No 干预)对抑郁、焦虑、自动思维、知觉和学习四项指标的影响，分别在 t1 和 t2 进行配对样本 t 检验。结果总结在表 2 中。

5.2.1 Test Group (n=20).

5.2.1 测试组(n = 20)。

- Depression: There was a significant difference in the PHQ-9 scores of the test group between t1 (M= 13.45 SD= 5.095) and t2(M= 8.25 SD= 4.166); t(19)= -3.71 , p= 0.00075). The magnitude of this effect was calculated as Cohen's d= 1.118. These results suggest that the use of the Chronicles app really did have an effect on the severity of depression as reported through the questionnaire. Specifically, by using this intervention the level of depression decreased in our test group.

抑郁: 治疗组 phq-9 评分在 t1(m = 13.45 SD = 5.095)和 t2(m = 8.25 SD = 4.166)之间有显著性差异，t (19) = -3.71，p = 0.00075。这种效应的大小计算为 Cohen's d = 1.118。这些结果表明，使用 Chronicles 应用程序确实对通过调查问卷报告的抑郁的严重程度有影响。具体而言，通过使用这种干预措施，我们测试组的抑郁水平下降。

- Anxiety: There was a significant difference in the GAD-7 scores of the test group between t1 (M= 10.55 SD= 5.624) and t2(M= 7.7 SD= 5.048); t(19)= -2.09 , p= 0.025). The magnitude of this effect was calculated as Cohen's d= 0.533. These re-sults suggest that the use of the Chronicles app really did have an effect on the severity of anxiety as reported through the questionnaire. Specifically, by using this intervention the level of anxiety decreased in our test group.

焦虑: 治疗组 gad-7 评分在 t1(m = 10.55 SD = 5.624)和 t2(m = 7.7 SD = 5.048)之间有显著性差异，t (19) = -2.09，p = 0.025。这种效应的大小计算为 Cohen's d = 0.533。这些结果表明，使用 Chronicles 应用程序确实对调查问卷报告的焦虑程度有影响。具体而言，通过使用这种干预措施，我们测试组的焦虑水平下降。

- Negative Automatic Thoughts: There was a significant difference in the ATQ-30 scores of the test group between t1 (M= 97.15 SD= 22.8) and t2(M= 81.65 SD= 24.17); $t(19) = -2.96$, $p = 0.004$. The magnitude of this effect was calculated as Cohen's $d = 0.66$. These results suggest that the use of the Chronicles app really did have an effect on the frequency of occurrence and degree of belief in negative automatic thoughts as reported through the questionnaire. Specifically, by using this intervention the frequency of occurrence and degree of belief in negative automatic thoughts decreased in our test group.

负性自动思维: 实验组 atq-30 分在 t1(m = 97.15 SD = 22.8) 和 t2(m = 81.65 SD = 24.17) 之间有显著性差异, $t(19) = -2.96$, $p = 0.004$ 。这种效应的大小计算为 Cohen's $d = 0.66$ 。这些结果表明, 使用 Chronicles 应用程序确实对负面自动想法的出现频率和信念程度有影响, 正如通过问卷调查所报告的那样。具体而言, 通过使用这种干预, 在我们的测试组中, 消极自动思维的发生频率和信念程度下降。

- Perception and Learning: There was a significant difference in the scores of the test group between t1(M= 6.55 SD= 1.395) and t2(M= 7.8 SD= 1.936); $t(19) = 4.075$, $p = 0.00032$. The magnitude of this effect was calculated as Cohen's $d = 0.741$. These results suggest that the use of the Chronicles app really did have an effect on how participants perceived thoughts, whether they saw them as rational or irrational, how well they had been able to internalise the concepts and how much information relating to cognitive distortions they had retained. Specifically, by using this intervention there seemed to be an increase in their knowledge and their understanding of irrational thoughts.

感知与学习: 治疗组与对照组比较, t1(m = 6.55 SD = 1.395) 与 t2(m = 7.8 SD = 1.936) 有显著性差异, $t(19) = 4.075$, $p = 0.00032$ 。这种效应的大小计算为 Cohen's $d = 0.741$ 。这些结果表明, 使用 Chronicles 应用程序确实对参与者如何感知思想产生了影响, 无论他们认为这些思想是理性的还是非理性的, 他们对这些概念的内化程度如何, 以及他们保留了与认知扭曲有关的信息。具体来说, 通过使用这种干预, 他们的知识和对非理性思维的理解似乎有所增加。

5.2.2 Control Group (n=20).

5.2.2 对照组 (n = 20)。

- Depression: There was no significant difference in the PHQ-9 scores of the control group between t1 (M= 11.15 SD= 5.932) and t2(M= 9.8 SD= 5.653); $t(19) = -1.6$, $p = 0.06306$. These results suggest that the use of the CBT Thought Diary app did not have a statistically significant effect on the severity of depression as reported through the questionnaire.

抑郁: 对照组 phq-9 评分 t1(m = 11.15 SD = 5.932) 与 t2(m = 9.8 SD = 5.653) 无显著性差异, $t(19) = -1.6$, $p = 0.06306$ 。这些结果表明, 使用 CBT Thought Diary 应用程序对通过问卷报告的抑郁症严重程度没有统计学显著影响。

- Anxiety: There was no significant difference in the GAD-7 scores of the control group between t1 (M= 8.95 SD= 5.206) and t2(M= 9.65 SD= 6.393); $t(19) = 0.742$, $p = 0.23358$.

These results suggest that the use of the CBT Thought Diary app did not have a statistically significant effect on the severity of anxiety as reported through the questionnaire.

焦虑: 对照组 gad-7 评分 t1(m = 8.95 SD = 5.206) 与 t2(m = 9.65 SD = 6.393) 无显著性差异, $t(19) = 0.742$, $p = 0.23358$ 。这些结果表明, 使用 CBT 思想日记应用程序对通过问卷报告的焦虑程度没有统计学显著影响。

- Negative Automatic Thoughts: There was no significant difference in the ATQ-30 scores of the control group between t1 (M= 88 SD= 31.24) and t2(M= 82.5 SD= 35.06); $t(19) = -1.51$, $p = 0.07383$. These results suggest that the use of the CBT Thought Diary app did not have a statistically significant effect on the frequency of occurrence and degree of belief in negative automatic thoughts as reported through the questionnaire.

消极自动思维: 对照组 atq-30 分在 t1(m = 88sd = 31.24) 和 t2(m = 82.5 SD = 35.06) 之间无显著性差异, $t(19) = -1.51$, $p = 0.07383$ 。这些结果表明, 使用 CBT 思维日记应用程序对负面自动思维的出现频率和信念程度没有统计学意义上的显著影响。

- Perception and Learning: There was no significant difference in the scores of the control group between t1(M= 6.35 SD= 1.387) and t2(M= 6.25 SD= 1.773); $t(19) = -0.357095$, $p = 0.36248$. These results suggest that the use of the CBT Thought Diary app did not have a statistically significant effect on how participants perceived thoughts, whether they saw them as rational or irrational, how well they had been able to internalise the concepts and how much information relating to cognitive distortions they had retained.

感知与学习: 对照组 t1(m = 6.35 SD = 1.387) 与 t2(m = 6.25 SD = 1.773) 得分无显著性差异, $t(19) = -0.357095$, $p = 0.36248$ 。这些结果表明, 使用认知行为疗法思维日记应用程序对参与者如何看待思维, 他们是否认为思维是理性的或非理性的, 他们如何能够内化这些概念, 以及他们保留了与认知扭曲有关的信息, 在统计学上没有显著影响。

5.2.3 Waitlist Group (n=20).

5.2.3 Waitlist 组 (n = 20)。

Table 2: The results of paired sample t-tests examining the effect of the interventions on each measure

表 2: 配对样本 t 检验的结果, 检验干预措施对每项措施的影响

| | | t | | t | | t- | p- | Cohen' |
|----------------------------------|-------------------|-------|-------|-------|-------|-------|---------|--------|
| | | 1 | | 2 | | valu | valu | s d |
| | | T | | T | | e | e | 科恩的 |
| | | 1 | | 2 | | T 值 | P 值 | d |
| | | S | | SD | | | | |
| | | mea | | mea | | | | |
| | | n | | n | | | | |
| | | 刻 | | 刻 | | | | |
| | | 薄 | | 薄 | | | | |
| | | 差 | | 差 | | | | |
| Test Group 测试小组 (n=20) | Depression 抑郁症 | 13.45 | 5.095 | 8.25 | 4.166 | -3.71 | 0.00075 | 1.118 |
| | Anxiety 焦虑 | | | | | -2.09 | | |
| | NAT | 10.55 | 5.624 | 7.7 | 5.048 | -2.09 | 0.025 | 0.533 |
| | NAT | 97.15 | 22.8 | 81.65 | 24.17 | -2.96 | 0.004 | 0.66 |
| | Perception 知觉 | 6.55 | 1.395 | 7.8 | 1.936 | 4.075 | 0.00032 | 0.741 |
| Control Group 控制室 (n=20) | Depression 抑郁症 | 11.15 | 5.932 | 9.8 | 5.653 | -1.6 | 0.06306 | N/A |
| | Anxiety 焦虑 | 8.95 | 5.206 | 9.65 | 6.393 | 0.742 | 0.23358 | N/a |
| | NAT | | | | | -1.51 | | N/A |
| | NAT | 88 | 31.24 | 82.5 | 35.06 | -1.51 | 0.07383 | N/a |
| | Perception 知觉 | 6.35 | 1.387 | 6.25 | 1.773 | 0.357 | 0.36248 | N/a |
| Waitlist Group 候补名单 (n=20) | Depression 抑郁症 | 11.25 | 5.014 | 9.4 | 5.093 | 4.796 | 0.00006 | 0.366 |
| | Anxiety 焦虑 | 8.05 | 5.031 | 8.4 | 5.744 | 0.526 | 0.30265 | N/A |
| | NAT | | | | | -0.89 | | N/A |
| | NAT | 86.15 | 32.37 | 82.4 | 34.75 | -0.89 | 0.19225 | N/a |
| | Perception 知觉 | 5.45 | 2.064 | 5.3 | 2.055 | 0.513 | 0.3071 | N/a |

• Depression: There was a significant difference in the PHQ-9 scores of the waitlist group between t1 (M= 11.25 SD= 5.014) and t2(M= 9.4 SD= 5.093); t(19)= -4.796 , p= 0.00006). The magnitude of this effect was calculated as Cohen's d= 0.366. These results suggest that the severity of depression decreased over time as reported through the questionnaire.

抑郁症: 候补组的 phq-9 分在 t1(m = 11.25 SD = 5.014)和 t2(m = 9.4 SD = 5.093)之间有显著性差异, t (19) = -4.796, p = 0.00006。这种效应的大小计算为 Cohen's d = 0.366。这些结果表明, 抑郁症的严重程度随着时间的推移而下降, 如通过问卷报告的那样。

• Anxiety: There was no significant difference in the GAD-7 scores of the waitlist group between t1 (M= 8.05 SD= 5.031) and t2(M= 8.4 SD= 5.744); t(19)= 0.526 , p=0.30265). These results suggest that there was no statistically significant change in anxiety levels over time, as reported through the questionnaire.

焦虑: 候补组 gad-7 评分在 t1(m = 8.05 SD = 5.031)和 t2(m = 8.4 SD = 5.744)之间无显著性差异, t (19) = 0.526, p = 0.30265。这些结果表明, 如通过问卷报告的, 随着时间的推移, 焦虑水平没有统计学显著变化。

• Negative Automatic Thoughts: There was no significant difference in the ATQ-30 scores of the waitlist group between t1 (M= 86.15 SD= 32.37) and t2(M= 82.4 SD= 34.75); t(19)= -0.89 , p= 0.19225). These results suggest that there was no statistically significant change in the frequency of occurrence and degree of belief in negative automatic thoughts over time, as reported through the questionnaire.

负性自动思维: 等待名单组的 atq-30 分在 t1(m = 86.15 SD = 32.37)和 t2(m = 82.4 SD = 34.75)之间无显著性差异; t (19) = -0.89, p = 0.19225)。这些结果表明, 随着时间的推移, 消极自动想法的出现频率和信念程度在统计学上没有显著变化, 正如通过问卷所报告的那样。

• Perception and Learning: There was no significant difference in the scores of the waitlist group between t1 (M= 5.45 SD= 2.064) and t2(M= 5.3 SD= 2.055); t(19)= -0.513 , p= 0.3071). These results suggest that there was no statistically significant change in how participants perceived thoughts, whether they saw them as rational or irrational, how well they had been able to internalise the concepts and how much information relating to cognitive distortions they had retained.

知觉与学习: 等待名单组 t1(m = 5.45 SD = 2.064)与 t2(m = 5.3 SD = 2.055)得分无显著性差异, t (19) = -0.513, p = 0.3071。这些结果表明, 参与者对思想的感知方式, 他们认为思想是理性的还是非理性的, 他们内化概念的能力有多好, 以及他们保留了多少与认知扭曲有关的信息, 在统计学上没有显著的变化。

5.3 Between Interventions

5.3 介入之间

• Depression: There was a significant effect of intervention on the change in PHQ-9 scores (F2,57= 4.651, p= 0.013462). Further post hoc Tukey's HSD pairwise comparisons indicated significant differences in scores between the test group

and the control group ($p= 0.01859$) as well as between the test group and the waitlist group ($p= 0.04618$), but no significant difference between the control group and the waitlist group ($p= 0.92959$).

抑郁: 干预对 $phq-9$ 评分变化有显著影响($F_{2,57} = 4.651$, $p = 0.013462$)。进一步的 Tukey's HSD 两两比较显示, 试验组与对照组之间、试验组与候补组之间的得分有显著性差异($p = 0.01859$), 而对照组与候补组之间的得分无显著性差异($p = 0.92959$)。

- Anxiety: There was a signifcant effect of intervention on the change in GAD-7 scores ($F_{2,57}= 3.602$, $p= 0.033638$). Further post hoc Tukey's HSD pairwise comparisons indicated a significant difference in scores between the test group and

焦虑: 干预对 $gad-7$ 评分变化有显著影响($F_{2,57} = 3.602$, $p = 0.033638$)。进一步的事后 Tukey 的 HSD 成对比较表明测试组和

Table 3: The results of a One-Way ANOVA examining the difference in effect between the interventions on each measure
表 3: 单因素方差分析的结果, 检查了每个措施的干预措施之间的效果差异

| Measure 措施 | F | p-value P 值 | Test:Cont | Test:Wait | Control:Wai |
|-------------------|-------|----------------|-----------|-----------|-------------|
| | | | rol | list | tlst |
| | | | 测试: 控 | 测试: 候 | Waitlist 控 |
| | | | 制 | 补名单 | 件: Waitlist |
| Depression 抑郁症 | 4.651 | 0.013462 | 0.01859 | 0.04618 | 0.92959 |
| Anxiety 焦虑 | 3.602 | 0.033638 | 0.04672 | 0.08062 | 0.96874 |
| NAT | | | | | |
| NAT | 3.196 | 0.048346 | 0.22839 | 0.04191 | 0.69333 |
| Perception 知觉 | 7.330 | 0.001468 | 0.00536 | 0.00376 | 0.99202 |

the control group ($p= 0.04672$) but no significant difference between the test group and the waitlist group ($p= 0.08062$) nor between the control group and the waitlist group ($p= 0.96874$).

对照组($p = 0.04672$), 实验组与候补组($p = 0.08062$)、对照组与候补组($p = 0.96874$)无显著性差异。

- Negative Automatic Thoughts: There was a signifcant ef- fect of intervention on the change in ATQ-30 scores ($F_{2,57}= 3.196$, $p= 0.048346$). Further post hoc Tukey's HSD pairwise comparisons indicated a significant difference in scores between the test group and the waitlist group ($p= 0.04191$) but no significant difference between the test group and the control group ($p= 0.22839$) nor between the control group and the waitlist group ($p= 0.69333$).

负性自动思维: 干预对 $atq-30$ 评分变化有显著影响($F_{2,57} = 3.196$, $p = 0.048346$)。进一步的事后 Tukey 的 HSD 成对比较显示, 试验组与候补组之间的得分有显著性差异($p = 0.04191$), 但试验组与对照组之间无显著性差异($p = 0.22839$), 对照组与候补组之间无显著性差异($p = 0.69333$)。

- Perception and Learning: There was a signifcant effect of intervention on the change in test scores ($F_{2,57}= 7.330$, $p= 0.001468$). Further post hoc Tukey's HSD pairwise comparisons indicated signifcant differences in scores between the test group and the control group ($p= 0.00536$) as well as between the test group and the waitlist group ($p= 0.00376$), but no signifcant difference between the control group and the waitlist group ($p= 0.99202$).

知觉与学习: 干预对考试成绩变化有显著影响($F_{2,57} = 7.330$, $p = 0.001468$)。进一步的事后 Tukey 的 HSD 成对比较显示, 试验组与对照组($p = 0.00536$)、试验组与候补组($p = 0.00376$)

之间的得分有显著性差异，而对照组与候补组之间的得分无显著性差异($p = 0.99202$)。

5.4 Qualitative Findings

5.4 定性研究结果

The exit survey at the end of the trial included a questionnaire with open-ended questions where participants were asked to reflect on their overall experience with the interventions. This data was thematically analyzed using two different methods. The data from the test group was analyzed using a deductive approach [32] whereby the extracted data was clustered into a set of predetermined themes. These themes corresponded to the gamification elements we incorporated in the Chronicles app, namely narrative and theme, personalization, and avatars and customization, along with the different components of our intervention, i.e. cognitive awareness and psychoeducation. The data from the control and waitlist groups was analyzed using an inductive approach [21] in which the data, after we familiarized ourselves with it, was coded and labeled. The coded data was then further reviewed to generate themes. Some important insights are mentioned here.

试验结束时的退出调查包括一份问卷，其中附有开放式问题，要求参与者反思他们在干预措施方面的总体经验。这些数据是使用两种不同的方法进行数学分析的。使用演绎方法[32]分析测试组的数据，将提取的数据聚集成一组预定的主题。这些主题对应于我们在 Chronicles 应用程序中整合的游戏化元素，即叙事和主题、个性化、化身和定制，以及我们干预的不同组成部分，即认知意识和心理教育。对照组和候补名单组的数据进行归纳分析[21]，其中的数据，在我们熟悉它之后，被编码和标记。然后进一步审查编码数据以生成主题。这里提到了一些重要的见解。

5.4.1 Test Group (Chronicles App). Narrative and Theme: The relatability of the contextualized storylines was something most participants commented on favourably, highlighting how they have gone through similar if not the exact same situations during their time at college. For example, a participant wrote, "It felt like I was reliving my own memories". For many, this factor facilitated their ability to position themselves within the narrative and better reflect on the choices they made within the application. A participant wrote, "All the scenarios were mostly something that I could personally

5.4.1 测试组(Chronicles App)。叙事和主题：大多数参与者对这些情境化的故事情节的相关性给予了肯定的评价，强调他们在大学期间是如何经历相似甚至完全相同的情况的。例如，一位参与者写道：“感觉就像我在重温自己的记忆。”。对于许多人来说，这个因素促进了他们将自己置身于叙事中的能力，并且更好地反思他们在应用程序中做出的选择。一位参与者写道：“所有的场景都是我个人能够做到的

relate to or have been through during my time at LUMS so it really
关于或已经通过在我的时间在 LUMS，所以它真的

What are you thinking?
你在想什么？

made me think about the choices and what I would do or had actually done when I was in that scenario". Others appreciated the ability to be presented with realistic and relatable scenarios where they could behave in a way they perceived as uncharacteristic of themselves. Describing this, a participant wrote, "The app really captured how life让我思考我的选择以及在那种情况下我会做什么或者实际上已经做了什么。"。另一些人则欣赏这种能力，他们能够面对现实和相关的情景，在这些情景中，他们能够以一种他们认为不符合自己特点的方式行事。一位参与者在描述这一点时写道：“这款应用真的捕捉到了生活是怎样的

inside LUMS goes. The different scenarios presented were interesting and I was able to make some choices which I wasn't able to do in college". 内心的生活。展示的不同场景都很有趣，我可以做出一些在大学里做不到的选择。”。

Participants also remarked on the contextualization of the visual design and how the aesthetics contributed to the level of engagement they felt with the scenarios. One participant wrote, "The

与会者还谈到视觉设计的语境化，以及美学如何促进他们对场景的参与程度。一位参与者写道：

visuals made the stories come to life, without them I wouldn't have had as much interest in the game" and another specifically commented on the attention to detail in the visual design, writing "The视觉效果让故事栩栩如生，如果没有它们，我就不会对游戏产生那么大的兴趣。"另一个人特别评论了视觉设计中细节的关注，他写道：visuals were a real highlight for me, especially the relatable little视觉效果对我来说是一个真正的亮点，尤其是那些

things like the shopping cart icon during course selection and the way the emails looked". Participants also attributed their honesty while selecting choices to the visual design; "Without the story and the比如选课时的购物车图标和邮件的样子。"。参与者还将他们在选择选项时的诚实归因于视觉设计；“没有故事和

graphics being so realistic I might have given a different answer, but图像是如此真实，我可能会给出不同的答案，但

this made me very honest with my choices because it was easy for me to actually see myself in that situation". Both the narratives and the visual design resulted in some participants feeling nostalgic and sentimental, which fostered a sense of personal connection with the application. A participant wrote, "The whole thing made这让我对自己的选择非常坦诚，因为我很容易在那种情况下看到自己。"。无论是叙事还是视觉设计都让一些参与者感到怀旧和感伤，这培养了一种与应用程序的个人联系。一位参与者写道：“整件事情me nostalgic and brought back so many memories so I automatically felt connected to the narrative". 我怀旧，带回了如此多的回忆，所以我自然而然地感到与故事联系在一起。”。

Personalization: A number of participants also referred to the immediate nature of the feedback when talking about how the application had helped them. One participant described the pop-up screens as "small reality checks" and another wrote, "I think I

个性化：许多参与者在谈到这个应用程序是如何帮助他们的时候，也提到了反馈的即时性。一个参与者将弹出的屏幕描述为“小的现实检查”，另一个参与者写道，“我认为我

learnt to question my own thoughts during real life scenarios. Seeing situations that I have found myself in being replayed in front of me with actual feedback gave me a chance to evaluate my own behaviour and

understand how I tend to overblow certain situations". Another participant remarked, "I liked being able to have my character reflect在现实生活中学会了质疑自己的想法。看到我发现自己在面对实际反馈时被重放的情景，让我有机会评估自己的行为，并理解我如何倾向于夸大某些情况。"。另一位参与者说：“我喜欢自己的性格得到反映

my real thoughts and get immediate feedback from the app about any bad tendencies I may have". 我的真实想法，并从应用程序中得到关于我可能有的任何不良倾向的即时反馈。”。

When talking about the different options presented for emotions and thoughts, most participants felt the list provided was extensive enough to always have a feeling or thought that fit. A participant wrote, "The options were very diverse and they really covered all the

当谈到情绪和想法的不同选择时，大多数参与者认为所提供的清单足够广泛，以至于总是有一种感觉或想法。一位参与者写道：“选择非常多样，它们真的涵盖了所有的

different choices/decisions that someone could've taken in real life. 人们在现实生活中可能做出的不同选择/决定。

There were positive reactions as well as negative ones and some neutral ones as well. They were very well thought out". Similarly, another participant commented, "Each time I was presented with options, my actual thought was right there". However, a couple of participants also indicated that they often wanted to be able to pick more than one option as they felt they could be thinking and feeling multiple things at the same time. One participant wrote, "The options showed有积极的反应，也有消极的反应和一些中立的反应。他们都是经过深思熟虑的。”。

同样，另一位参与者评论说，“每次我面对选项时，我的真实想法都是正确的。”。然而，一些参与者也表示，他们经常希望能够选择一个以上的选项，因为他们觉得他们可以同时思考和感受多种事物。一位参与者写道：“选项表明

clearly different feelings but at times I wanted to choose more than one明显不同的感受，但有时我想选择不止一种

option showing my mixed or indecisive feeling at that point in time" and another wrote, "When something like this happens I don't just have one thought running through my head". Conversely, others felt that being forced to choose one actually helped deeper reflection as they had to identify the dominant thought which would have a greater effect on their mental state. For example, a participant另一个人写道：“当这样的事情发生时，我的脑子里不只有一个念头。”。相反，另一些人认为，被迫选择一个实际上有助于更深刻的反省，因为他们必须确定主导思想，这将对他们的精神状态产生更大的影响。例如，一个参与者

5.4.2 Control Group (CBT Thought Diary App). Self-Monitoring: Several participants in the control group felt that the highlight of their experience with the app had been the act of documenting or recording their thoughts on a regular basis. While some felt the regularity provided a kind of structure to their day ("The necessary timeout sets a routine for the day"), others also felt the designated

5.4.2 控制组(CBT 思维日记应用)。自我监控: 对照组的一些参与者认为, 他们使用这款应用程序的最大体验是定期记录或记录他们的想法。虽然有些人认为这种规律性为他们的一天提供了一种结构("必要的超时设置了一天的例行公事"), 其他人也认为这是指定的

I recorded my thoughts" and "I felt relaxed somehow after writing down my feelings".

我记录下我的想法"和"写下我的感受后,我感到很放松"。

Interestingly, these participants were also able to identify patterns in their behaviour through this daily record, and were also motivated to be more proactive regarding their mental health. A participant highlighted this by writing, "When I wrote my thoughts

有趣的是,这些参与者也能够通过这些日常记录确定他们的行为模式,并且也被激励对他们的心理健康更加积极主动。一位参与者强调了这一点,他写道:"当我写下我的想法时

and read them again after that I realized how stupid my thoughts are just because of the rise of the emotions and those thoughts disturb everything in me, so I started to work on my personal growth". Simi-larly, another participant wrote, "I saw that there are some negative 然后又读了一遍,我意识到我的想法是多么愚蠢,因为情绪的上升,这些想法扰乱了我内心的一切,所以我开始努力我的个人成长。"。另一位参与者写道:"我看到了一些消极的东西

behaviours that I continuously repeat again and again that I need to work on in order to improve myself". One participant also succinctly wrote, "I learnt to value my thoughts" which indicated that this exercise had shed light on the link between thoughts and mental health.

我不断重复的行为,为了提高自己,我需要不断努力。"。一位参与者还简洁地写道,"我学会了珍惜我的思想",这表明这项练习阐明了思想与心理健康之间的联系。

Data Privacy: In this group too, there were concerns about data privacy and security. A participant wrote, "It was a great experience

数据隐私:在这个小组中,也有关于数据隐私和安全的担忧。一位参与者写道:"这是一次很棒的经历

and I felt better to take out my anxiety onto something but the thought that someone would read my dark thoughts and this digital diary is not in my personal safe place, I may not have shared everything".

我觉得把焦虑发泄到其他事情上会更好,但一想到有人会读到我的黑暗想法,这本电子日记不在我个人安全的地方,我可能没有分享一切。"。

6 DISCUSSION

讨论

Through this work, we explored the potential of using a combination of interactive storytelling and CBT to address the growing concerns about depression and anxiety among college students. We designed a self-guided mHealth application with interactive storytelling and gamification mechanisms to foster a therapeutic alliance that could help users better learn certain psychological concepts and understand their real world impact, and identify cognitive distortions in their thoughts that could be contributing to negative feelings and behaviours. The randomized controlled trial was designed to investigate the impact of this application on levels of depression, anxiety, negative automatic thoughts as well as on the perception of rational and irrational thoughts and the internalization of psychological concepts.

通过这项工作,我们探索了使用交互式讲故事和认知行为疗法相结合来解决大学生对抑郁和焦虑日益增长的担忧的潜力。我们设计了一个具有交互式讲故事和游戏化机制的自我引导的 mHealth 应用程序,以促进一个治疗联盟,该联盟可以帮助用户更好地学习某些心理概念,

理解他们对现实世界的影响,并识别他们思想中可能导致负面情绪和行为的认知扭曲。本研究采用随机对照试验的方法,探讨该方法对抑郁、焦虑、消极自动思维水平、理性思维和非理性思维的感知以及心理概念内化的影响。

Although one of the eligibility criteria for participants in this study was that they must not be in therapy or currently taking any medication for depression and anxiety, the initial results for all participants (t1) showed that their PHQ-9 and GAD-7 scores ranged from mild to severe. This result in itself was important as it indicated the need for mental health solutions among college students and corroborated research showing that majority of individuals with mental health issues do not receive treatment [49].

虽然本研究参与者的资格标准之一是他们不得接受治疗或目前正在服用任何治疗抑郁和焦虑的药物,但所有参与者的初步结果(t1)显示,他们的 phq-9 和 gad-7 评分从轻度到重度不等。这一结果本身就很重要,因为它表明需要在大学生中采取心理健康解决方案,并且经证实的研究表明,大多数有心理健康问题的个人没有得到治疗[49]。

Consistent with the initial hypothesis behind the design of the application, the results of the study indicated a significant effect of the Chronicles app on all measures. Participants in the test group reported significantly lower scores on depression, anxiety and negative automatic thoughts and significantly higher scores on the perception and learning measure. These results show that a combination of CBT and interactive storytelling in a gamified mobile application can be an effective self-guided intervention for depression and anxiety specifically among college students.

与应用程序设计背后的初始假设一致,研究结果表明 Chronicles 应用程序对所有测量都有显著影响。测试组的参与者在抑郁、焦虑和消极的自动思维方面得分明显较低,在感知和学习方面得分明显较高。这些结果表明,在游戏化的手机应用中结合认知行为疗法和交互式讲故事可以有效地自我引导干预抑郁和焦虑,特别是在大学生中。

Comparison with the control conditions indicated that the test group participants who used the Chronicles app showed a more significant decrease in depression scores as compared to both the control and the waitlist group. For anxiety, the participants who used

与对照组相比,使用 Chronicles 应用程序的实验组受试者抑郁得分显著低于对照组和候补组。对于焦虑,使用

What are you thinking?
你在想什么？

the Chronicles app showed a more significant decrease compared to the control group, but not compared to the waitlist group. Conversely, for negative automatic thoughts, Chronicles users showed a more significant decrease compared to the waitlist group, but not compared to the control group. Finally, in terms of perception and learning, the Chronicles users showed a more significant increase compared to both the control and the waitlist groups. However, in terms of the comparison between the Chronicles users and the waitlist group specifically, it must be noted that this data point is not as reliable due to the fact that the test group's initial scores for the perception and learning measure were higher than those of the waitlist group, despite the random assignment of subjects. Such a discrepancy was not present for any other initial measure across all groups. There was no significant difference in the change in scores between the control group and the waitlist group across all measures.

与对照组相比，Chronicles 应用程序显示出更显著的下降，但是与候补组相比并没有下降。相反，对于消极的自动思维，Chronicles 用户显示出比等待名单组更显著的下降，但是与对照组相比并没有下降。最后，在感知和学习方面，与对照组和候补组相比，Chronicles 的用户显示出更显著的增长。然而，就 Chronicles 使用者与候补名单组之间的比较而言，必须指出的是，这一数据点并不可靠，因为测试组的知觉和学习测量的初始分数高于候补名单组，尽管受试者是随机分配的。所有组中的任何其他初始测量都没有这种差异。在所有措施中，对照组和等待名单组之间的分数变化没有显著差异。

Given that Chronicles users scored significantly better than the control group in terms of both depression and anxiety, the primary measures of the trial, this suggests that the use of interactive storytelling and gamification elements in this application contributed to its greater efficacy. Moreover, the Chronicles users also scored significantly higher than the control group in one of the secondary measures that assessed how participants perceive rational and irrational thoughts and how well they internalized and retained knowledge about psychological concepts they had learnt in the apps. This also provides evidence of the fact that the interactive storytelling and gamification approach can improve the efficacy of psychoeducational modules within mHealth apps. While the participants who used the Chronicles app also showed a significant decrease in negative automatic thoughts at the end of the trial, this change was not significant in comparison to the control group so we cannot rule out the possibility that this particular decrease was not only a result of the interactive storytelling and gamification elements but also the exposure to the underlying CBT intervention. Although, since negative automatic thoughts directly correlate to the pathogenesis and severity of depression and anxiety, this discrepancy does not alter the overall insights derived from the experimental results.

考虑到 Chronicles 的使用者在抑郁和焦虑方面的得分明显高于对照组，这是试验的主要指标，这表明在这个应用程序中使用交互式的故事讲述和游戏化元素有助于提高其效果。此外，Chronicles 用户在一项次要测试中的得分也明显高于对照组，这项测试评估了参与者如何感知理性和非理性思维，以及他们如何内化和保留在应用程序中学到的关于心理学概念的知识。这也提供了这样一个事实的证据，即互动式的故事叙述和游戏化方法可以提高移动健康应用程序中心理教育模块的效果。尽管使用 Chronicles 应用程序的参与者在试验结束时也

显示出负面自动思维的显著减少，但与对照组相比，这种变化并不显著，因此我们不能排除这种特殊减少的可能性，即这种减少不仅是交互式讲故事和游戏化元素的结果，而且也是潜在的认知行为干预的结果。虽然，由于消极的自动思维与抑郁和焦虑的发病机制和严重程度直接相关，这种差异并没有改变从实验结果得出的总体见解。

The use of storytelling was central to our design because of its unique ability to combine several gamification elements and strategies that could improve the efficacy of a self-guided CBT intervention in various ways. The qualitative data obtained from our initial usability study as well as from the participant feedback gathered at the end of the randomized controlled trial showed that majority of the users felt that the contextualization of the narratives and the visual design (narrative and theme) were the most important factors in increasing their engagement and motivation to use the application, followed by personalization and then customization and avatars.

使用讲故事是我们设计的核心，因为它独特的能力结合了几个游戏化元素和策略，可以提高自我引导的认知行为疗法干预的效果在各种方式。从我们最初的可用性研究以及在随机对照试验结束时收集的参与者反馈中获得的定性数据表明，大多数用户认为叙述的语境化和视觉设计(叙述和主题)是增加他们使用该应用程序的参与度和动机的最重要因素，其次是个性化，然后是个性化和化身。

By contextualising the narratives presented in the application, we intended to cater to the user's need for relatedness and personal relevance, both of which are linked to increased intrinsic motivation and consequently engagement and, therefore, a therapeutic alliance [35, 87]. Our qualitative findings were in line with this as all participants who used the Chronicles app commented favourably on the relatability of the scenarios presented, and attributed this to

通过将应用程序中的叙述置于上下文环境中，我们旨在满足用户对相关性和个人相关性的需求，这两者都与增加的内在动机相关联，从而增加参与度，从而形成治疗联盟[35,87]。我们的定性结果与此相符，因为所有使用 Chronicles 应用程序的参与者都对所呈现的场景的相关性给予了积极的评价，并将其归因于

their engagement and sustained interest in the application. Participants also mentioned that the relatability enabled them to picture themselves in the scenarios and make honest choices. This is also in line with literature that suggests a particularly immersive narrative can result in the perception of being transported into the fictional or alternate world being presented, and that this 'transportation' can influence cognition [48]. The feedback also highlighted the importance of the visual design; the contextualised landscapes helped to complement the narratives and increase the relatability and therefore engagement. It is important to note that a trade-off exists between relatability and scale. However, given the positive impact of contextualization on engagement and efficacy as seen in our results, as well as findings from literature, which suggest that context has a marked impact on the experience of mental health [63], the benefits of this approach may outweigh the potential cost.

他们对申请的参与和持续的兴趣。Participants 还提到, 这种相关性使他们能够在场景中想象自己, 并做出诚实的选择。这也符合文学的说法, 即一个特别沉浸式的叙事可以导致感知被运送到虚构的或另一个世界被呈现, 这种“运送”可以影响认知[48]。反馈也强调了视觉设计的重要性; 情景化的景观有助于补充叙事, 增加相关性, 从而增加参与度。值得注意的是, 在相关性和规模之间存在一种交易。然而, 鉴于我们的研究结果以及文献的研究结果表明, 情境化对心理健康的体验有显著的影响, 这种方法的好处可能超过潜在的成本。

Having the landscapes depict the familiar college campus also facilitated a sense of belonging and attachment to the application environment, thereby also enhancing intrinsic motivation by catering to the need for social relatedness [79]. Feedback from participants showed that the landscapes evoked a sense of nostalgia and therefore an increased connection to the narrative. This insight also has implications particularly for the psychoeducational aspect of applications, as emotion has been linked to memory and retention of messages [84].

景观描绘了熟悉的大学校园, 也促进了归属感和对应用环境的依恋, 从而也增强了内在动机, 迎合社会关系的需要[79]。参与者的反馈显示, 景观引起了怀旧感, 因此增加了与叙事的联系。这种见解也特别涉及应用的心理教育方面, 因为情绪与记忆和信息保留有关[84]。

Personalization was another important factor in the design of our application. Beyond the storylines being personalized through contextual relevance, the application provided feedback to the user in the form of pop-up screens containing information about any cognitive distortion reflected in their choices. Our qualitative findings showed participants from the test group particularly appreciating the relevance as well as the immediacy of this feedback. Conversely, participants in the control group who used the CBT Thought Diary app commented on how they disliked having to input multiple entries before getting any feedback. This was in line with previous research that indicates that matching the content of an intervention to a user's psychosocial or behavioural characteristics is perceived as personally relevant which enhances engagement [15]. Other literature such as the Elaboration Likelihood Model also suggests personal relevance can influence an individual's motivation [76]. Personalization is therefore able to foster a therapeutic alliance in two ways; by influencing motivation, and through its direct link with the broader characteristic of interactivity which has been highlighted

as a potential means of creating a bidirectional relationship between the user and the digital intervention [87].

个性化是我们应用程序设计中的另一个重要因素。除了通过上下文相关性使故事情节个性化之外, 应用程序还以弹出屏幕的形式向用户提供反馈, 其中包含关于用户选择中反映的任何认知扭曲的信息。我们的定性结果显示, 来自测试组的参与者特别欣赏这种反馈的相关性和即时性。相反, 使用 CBT Thought Diary 应用程序的对照组参与者评论说, 他们不喜欢在得到任何反馈之前必须输入多个条目。这与先前的研究一致, 研究表明, 将干预措施的内容与使用者的心理社会或行为特征相匹配, 被认为是与个人有关的, 可以增强参与[15]。其他文献, 如思考可能性模式, 也表明个人相关性可以影响个人的动机[76]。因此, 个性化能够以两种方式促进治疗联盟: 通过影响动机, 以及通过其与更广泛的互动特性的直接联系, 这种联系已被强调为在用户和数字干预之间建立双向关系的潜在手段[87]。

This characteristic of interactivity can include not only personalization strategies but also the degree to which a user feels in control when using a digital intervention [50]. The medium of storytelling also enabled us to seamlessly incorporate gamification strategies such as customization and avatars, which fulfill this need for user autonomy and control, therefore enhancing the users' intrinsic motivation and contributing to the therapeutic alliance.

这种互动的特性不仅包括个性化策略, 还包括用户在使用数字干预时感觉到的控制程度[50]。讲故事的媒介也使我们能够无缝地结合游戏化策略, 如定制和化身, 这满足了用户自主和控制的需要, 从而增强了用户的内在动机, 并有助于治疗联盟。

The results from the control group in our study also corroborated existing research into why self-guided CBT applications have not been as effective as guided alternatives in the past. Research has shown that the importance of support within digital interventions is mainly linked to the user's need for motivation to engage and discipline to carry out the tasks [47, 85]. Participant feedback

在我们的研究中, 来自对照组的结果也证实了现有的研究, 即为什么自我引导的认知行为疗法在过去不如引导的替代疗法有效。研究表明, 数字干预中支持的重要性主要与用户需要激励和约束来执行任务有关[47,85]。参与者反馈

echoed this, with several of them commenting that it was difficult to carry out the thought analysis activities on a regular basis. Furthermore, the feedback also indicated that the participants expected some more information or guidance when it came to analysing their thoughts, which also sheds light on an interplay between prior expectations and the perceived difficulty of a task. Since the quantitative data also showed that the test group had significantly better scores than the control group for primary measures, this suggests that there is certainly a benefit to incorporating cognitive restructuring in a more implicit manner that can then also provide motivation for continuous engagement and adherence.

他们对此表示赞同, 其中一些人评论说, 很难定期开展思想分析活动。此外, 反馈还表明, 参与者期望在分析他们的想法时获得更多的信息或指导, 这也说明了先前的期望与感知到的任务难度之间的相互作用。由于定量数据还显示, 测试组在主要测量方面的得分明显优于对照组, 这表明, 以更隐含的方式纳入认知重组肯定是有益的, 这种方式也可以为持续参与和坚持提供动机。

Interestingly, some feedback from the control group indicated disappointment in the CBT Thought Diary application because participants were not satisfied with the perceived efficacy of the thought analysis module and concluded that the app's value was more in terms of a journal, a place to record rather than to reflect and analyse. The tone of this feedback was in contrast to the feedback from the waitlist group, in which several participants reported a positive experience with our daily diary form, commenting that the mere act of writing everyday had led to reflection and a positive impact on mood. This was reflected in the quantitative data as well, as there was no significant difference between the waitlist group and the control group across any of the measures. This could be indicative of the fact that the efficacy of the CBT Thought Diary app could have more to do with the act of regular journaling and writing rather than with the cognitive restructuring module of the application. This is important to consider, as it highlights the need to improve current digital interventions in a way that takes advantage of the unique characteristics of technology. The limited efficacy of existing CBT applications could therefore have to do with attempting to directly translate traditional therapeutic techniques onto a digital medium, rather than leveraging the features of a mobile application.

有趣的是, 来自对照组的一些反馈显示, CBT 思维日记应用程序令人失望, 因为参与者对思维分析模块的感知效果不满意, 并得出结论认为, 该应用程序的价值更多地体现在日记上, 一个记录而不是反思和分析的地方。这种反馈的语气与候补小组的反馈形成了鲜明的对比。在候补小组中, 一些参与者报告了我们每天写日记的积极体验, 他们评论说, 仅仅是每天写日记的行为就会导致反思, 并对情绪产生积极的影响。这也反映在定量数据中, 因为在任何措施中, 等待名单组和对照组之间没有显著差异。这可能表明, CBT 思维日记应用程序的功效可能更多地与日记和写作行为有关, 而不是与应用程序的认知重组模块有关。这是需要考虑的重要因素, 因为它强调了以利用技术独特特性的方式改进当前数字干预的必要性。因此, 现有认知行为疗法应用的有限功效可能与试图将传统治疗技术直接转化为数字媒介有关, 而不是利用移动应用的特点有关。

The above insights were derived from an analysis of the quantitative data alongside the qualitative findings. On the basis

of these insights we recommend the use of various strategies to cultivate a therapeutic alliance through increased motivation and engagement, such as interactivity, contextualisation through narrative and theme, personalization and customization. Since all these factors are interlinked, we also recommend the medium of storytelling as a viable method that can seamlessly incorporate all these elements to provide effective results.

上述见解来自对定量数据和定性结果的分析。在这些见解的基础上, 我们建议使用各种策略, 通过增加动机和参与来培养治疗联盟, 如互动, 通过叙述和主题的情境化, 个性化和个性化。由于所有这些因素是相互关联的, 我们也推荐讲故事的媒介作为一种可行的方法, 可以无缝地结合所有这些元素, 以提供有效的结果。

6.1 Limitations

6.1 限制

Finally, it is important to acknowledge the limitations of this study. Since we recruited our participants through opportunity sampling, there is always the possibility of a self-selection bias in the sample i.e. those students who agreed to take part in the study may have more of a prior interest in issues of mental health and therefore a greater understanding of issues compared to the general population. Thus future work in this area could undertake a study with a greater sample size to ensure the external validity of the data. Additionally, since our study was testing self-guided applications, it is important to note that there is a level of human support and motivation to engage that occurs simply as a result of being part of a research study. Future work may also benefit from a greater time
最后, 必须承认本研究的局限性。由于我们是通过机会抽样招募参与者的, 样本中总是存在自我选择偏误的可能性, 即那些同意参加研究的学生可能对精神健康问题更感兴趣, 因此与一般人群相比, 他们对问题的理解更深。因此, 未来在这个领域的工作可以进行一项样本量更大的研究, 以确保数据的外部效度。此外, 由于我们的研究是测试自我引导的应用程序, 重要的是要注意到, 有一定程度的人类支持和参与的动机, 这仅仅是作为研究的一部分发生的结果。未来的工作也可能会受益于更长的时间

duration between test points to better understand real-world applications. Quantitative data on app-usage time can also be collected to substantiate results with more extensive data on engagement, to corroborate our current qualitative findings. This will also provide insights on how long each participant actually engaged with the app and whether they followed the recommendation of 5-10 min-utes a day as instructed at the start of the trial. Moreover, while we did instruct the participants of the control group to only use the thought analysis module of the CBT Thought Diary app, we know from the feedback that some participants also explored other features of the app such as the Gratitude journal, which could have influenced the results. Finally, our study was conducted during the COVID-19 pandemic, which may have had an effect on the students' initial levels of depression and anxiety compared to ordinary baseline levels, or a greater susceptibility to mental health issues.

测试点之间的持续时间,以更好地理解实际应用程序。还可以收集关于应用程序使用时间的定量数据,以用更广泛的参与数据来证实结果,以证实我们目前的定性结果。这也将提供关于每个参与者实际使用该应用程序多长时间的见解,以及他们是否遵循了试验开始时指示的每天 5-10 分钟的建议。此外,虽然我们指示控制组的参与者只使用认知行为疗法思维日记应用程序的思维分析模块,但从反馈中得知,一些参与者还探索了该应用程序的其他功能,如感恩日记,这可能会影响结果。最后,我们的研究是在 2019 冠状病毒疾病大流行期间进行的,与普通的基线水平相比,这可能会对学生的初始抑郁和焦虑水平产生了影响,或者对心理健康问题的易感性更高。

7 CONCLUSION

结论

In this paper we presented the design of a self-guided mHealth application that uses CBT, interactive storytelling and gamification to help college students with depression and anxiety, and the results from a randomized controlled trial conducted to investigate the effect of this application and whether this approach can improve the efficacy of existing self-guided CBT applications. We found that our application had a significant effect on both the primary measures, depression and anxiety, as well as the secondary measures of negative automatic thoughts and perception and learning. We also found that our application had a greater effect on the measures as compared to the control intervention which was chosen specifically as it was representative of majority of the existing self-guided CBT applications. These findings suggest that combining CBT with interactive storytelling and other gamification mechanisms can increase the efficacy of self-guided mHealth applications for depression and anxiety, by incorporating strategies that contribute to greater engagement and motivation and foster a therapeutic alliance between the users and the digital intervention. We are hopeful that future researchers will benefit from these insights while designing digital solutions for mental health, particularly for college students.

本文介绍了一个利用认知行为疗法(CBT)、交互式讲故事和游戏化技术帮助抑郁和焦虑大学生的自我导向移动健康应用程序的设计,以及随机对照试验的结果,以探讨该应用程序的效果,以及该方法能否提高现有自我导向 CBT 应用程序的效果。我们发现我们的应用对抑郁和焦虑的主要测量指标以及负性自动思维和知觉与学习的次要测量指标都有显著的影响。我们还发现,我们的应用有更大的影响措施相比,控制干预是选择具体的,因为它是代表大多数现有的自我引导认知行

为疗法的应用。这些结果表明,将认知行为疗法与互动式讲故事和其他游戏化机制相结合,可以通过纳入有助于提高参与度和动机的策略,并促进用户与数字干预之间的治疗联盟,从而提高自我引导的移动健康应用程序治疗抑郁和焦虑的效果。我们希望未来的研究人员将从这些见解中受益,同时设计心理健康的数字解决方案,特别是为大学生设计。

REFERENCES

参考文献

- [1] [n. d.]. Anxiety and Depression: More College Students Seeking Help | Time. <https://time.com/5190291/anxiety-depression-college-university-students/>. (Accessed on 01/26/2021).
焦虑和抑郁:更多的大学生寻求帮助。
- [2] [n. d.]. Depression. <https://www.who.int/news-room/fact-sheets/detail/depression>. (Accessed on 01/25/2021).
抑郁症 <https://www.who.int/news-room/facts-sheets/detail/Depression>.
- [3] [n. d.]. Depression and Anxiety Among College Students - The Jed Foundation (JED). <https://www.jedfoundation.org/depression-and-anxiety-among-college-students/>. (Accessed on 01/25/2021).
大学生中的抑郁和焦虑 - JED 基金会 <https://www.jedfoundation.org/Depression-and-Anxiety-Among-College-Students/>.
- [4] Aino Ahtinen, Elina Mattila, Pasi Valkkynen, Kirsikka Kaipainen, Toni Vanhala, Miikka Ermes, Essi Sairanen, Tero Myllymäki, and Raimo Lappalainen. 2013. Mobile mental wellness training for stress management: feasibility and design implications based on a one-month field study. *JMIR mHealth and uHealth* 1, 2 (2013), e11.
Aino Ahtinen, Elina Mattila, Pasi Valkkynen, Kirsikka Kaipainen, Toni Vanhala, Miikka Ermes, Essi Sairanen, Tero myllymäki, 和 ramo Lappalainen. 2013 年。移动精神健康训练的压力管理:可行性和设计的影响,基于一个月的实地研究。JMIR mHealth 和 uHealth 1,2(2013), e11。
- [5] Olaiya Aina. 1999. The Importance of Oral Storytelling in Literacy Development. *Ohio Reading Teacher* 33, 1 (1999), 15–18.
Olaiya Aina. 1999. 口头讲故事在识字发展中的重要性。俄亥俄州阅读教师 33,1(1999), 15-18。
- [6] Renee EE Anderson, Susan H Spence, Caroline L Donovan, Sonja March, Samantha Prosser, and Justin Kenardy. 2012. Working alliance in online cognitive behavior therapy for anxiety disorders in youth: comparison with clinic delivery and its role in predicting outcome. *Journal of medical Internet research* 14, 3 (2012), e88.
Renee EE Anderson, Susan h Spence, Caroline l Donovan, Sonja March, Samantha Prosser, and Justin Kenardy. 2012 年。青少年焦虑症在线认知行为治疗中的工作联盟:与临床分娩的比较及其在预测结果中的作用。医学互联网研究杂志 14,3(2012), e88。
- [7] Leonard A Annetta. 2010. The "I's" have it: A framework for serious educational game design. *Review of General Psychology* 14, 2 (2010), 105–113.
Leonard a annette. 2010 年。"i's"有它:一个严肃的教育游戏设计框架。综述《普通心理学》14,2(2010), 105-113。
- [8] Jeffrey Jensen Arnett. 2000. Emerging adulthood: A theory of development from the late teens through the twenties. *American psychologist* 55, 5 (2000), 469.
杰弗里·詹森·阿内特. 2000 年。初显成年期:一个从十几岁到二十几岁的发展理论。美国心理学家 55,5(2000), 469。

What are you thinking?
你在想什么？

- [9] David Bakker, Nikolaos Kazantzis, Debra Rickwood, and Nikki Rickard. 2016. Mental health smartphone apps: review and evidence-based recommendations for future developments. *JMIR mental health* 3, 1 (2016), e4984.
- David Bakker Nikolaos Kazantzis Debra Rickwood 和 Nikki Rickard. 2016 年。心理健康智能手机应用：未来发展的回顾和循证建议。JMIR 精神健康 3,1(2016) , e4984。
- [10] David Bakker, Nikolaos Kazantzis, Debra Rickwood, and Nikki Rickard. 2018. A randomized controlled trial of three smartphone apps for enhancing public mental health. *Behaviour Research and Therapy* 109 (2018), 75–83.
- David Bakker Nikolaos Kazantzis Debra Rickwood 和 Nikki Rickard. 2018 年。三款智能手机应用程序促进公众心理健康的随机对照试验。行为研究和治疗 109(2018) , 75-83。
- [11] Azy Barak, Liat Hen, Meyran Boniel-Nissim, and Na'ama Shapira. 2008. A comprehensive review and a meta-analysis of the effectiveness of internet-based psychotherapeutic interventions. *Journal of Technology in Human services* 26, 2-4 (2008), 109–160.
- Azy Barak, Liat Hen, Meyran Boniel-Nissim, and na'ama Shapira. 2008 年。基于互联网的心理治疗干预有效性的综合评价和荟萃分析。人类服务技术杂志 26,2-4(2008) , 109-160。
- [12] Moderator: Tom Baranowski, Participants: Amy Shirong Lu, Richard Buday, Elizabeth J Lyons, Jesse Schell, and Carmen Russoniello. 2013. Stories in games for health: more pros or cons? *GAMES FOR HEALTH: Research, Development, and Clinical Applications* 2, 5 (2013), 256–263.
- 主持人: Tom Baranowski 参与者: Amy Shirong Lu Richard Buday Elizabeth j Lyons Jesse Schell 和 Carmen Russoniello. 2013 年。健康游戏中的故事: 更多优点还是缺点? 健康游戏: 研究、开发和临床应用 2,5(2013) , 256-263。
- [13] Tom Baranowski, Janice Baranowski, Karen W Cullen, Tara Marsh, Noemi Islam, Issa Zakeri, Lauren Honess-Morreale, and Carl Demoor. 2003. Squire's Quest!: Dietary outcome evaluation of a multimedia game. *American journal of preventive medicine* 24, 1 (2003), 52–61.
- Tom Baranowski, Janice Baranowski, Karen w Cullen, Tara Marsh, Noemi Islam, Issa Zakeri, Lauren Honess-Morreale, and Carl Demoor. 2003 年。乡绅的探索! 多媒体游戏的饮食结果评估。美国预防医学杂志 24,1(2003) , 52-61。
- [14] Tom Baranowski, Richard Buday, Debbie I Thompson, and Janice Baranowski. 2008. Playing for real: video games and stories for health-related behavior change. *American journal of preventive medicine* 34, 1 (2008), 74–82.
- Tom Baranowski Richard Buday debbie i Thompson 和 Janice Baranowski. 2008. 玩真的: 电子游戏和健康相关行为改变的故事。美国预防医学杂志 34,1(2008) , 74-82。
- [15] Saraswathi Bellur and S Shyam Sundar. 2017. Talking health with a machine: How does message interactivity affect attitudes and cognitions? *Human Communication Research* 43, 1 (2017), 25–53.
- Saraswathi Bellur and s Shyam Sundar. 二〇一七年。与机器谈论健康: 信息互动是如何影响态度和认知的? 人类沟通研究 43,1(2017) , 25-53。
- [16] Thomas Berger, Katja Hämmerli, Nina Gubser, Gerhard Andersson, and Franz Caspar. 2011. Internet-based treatment of depression: a randomized controlled trial comparing guided with unguided self-help. *Cognitive behaviour therapy* 40, 4 (2011), 251–266.
- Thomas Berger Katja hammerli Nina Gubser Gerhard Andersson 还有 Franz Caspar. 2011 年。基于互联网的抑郁症治疗: 一项比较指导与非指导自助的随机对照试验。认知行为疗法 40,4(2011) , 251-266。
- [17] Amelia J Birney, Rebecca Gunn, Jeremy K Russell, and Dennis V Ary. 2016. MoodHacker mobile web app with email for adults to self-manage mild-to-moderate depression: randomized controlled trial. *JMIR mHealth and uHealth* 4, 1 (2016), e8.
- Amelia j Birney, Rebecca Gunn, Jeremy k Russell, and Dennis v Ary. 2016 年。MoodHacker 手机网络应用程序与电子邮件为成年人自我管理轻度到中度抑郁: 随机对照试验。JMIR mHealth 和 uHealth 4,1(2016) , e8。
- [18] Carlos Blanco, Mayumi Okuda, Crystal Wright, Deborah S Hasin, Bridget F Grant, Shang-Min Liu, and Mark Olfson. 2008. Mental health of college students and their non-college-attending peers: Results from the national epidemiologic study on alcohol and related conditions. *Archives of general psychiatry* 65, 12 (2008), 1429–1437.
- Carlos Blanco Mayumi Okuda Crystal Wright Deborah Hasin Bridget f Grant Liu Shang-Min Liu 和 Mark Olfson. 二〇〇八年。大学生及其非大学同龄人的心理健康: 酒精及相关条件的国家流行病学研究结果。普通精神病学档案 65,12(2008) , 1429-1437。
- [19] Edward S Bordin. 1979. The generalizability of the psychoanalytic concept of the working alliance. *Psychotherapy: Theory, research & practice* 16, 3 (1979), 252.
- 爱德华·s·博丹. 1979 年。工作联盟的精神分析概念的普遍性。心理治疗: 理论、研究和实践 16,3(1979) , 252。
- [20] Judith Borghouts, Elizabeth Eikley, Gloria Mark, Cinthia De Leon, Stephen M Schueller, Margaret Schneider, Nicole Stadnick, Kai Zheng, Dana Mukamel, and Dara H Sorkin. 2021. Barriers to and facilitators of user engagement with digital mental health interventions: systematic review. *Journal of medical Internet research* 23, 3 (2021), e24387.
- Judith Borghouts Elizabeth Eikley Gloria Mark Cinthia De Leon Stephen m Schueller Margaret Schneider Nicole Stadnick Kai Zheng Dana Mukamel 和 Dara h Sorkin. 2021 年。用户参与数字心理健康干预的障碍和促进者: 系统综述。医学互联网研究杂志 23,3(2021) , e24387。
- [21] Richard E Boyatzis. 1998. Transforming qualitative information: Thematic analysis and code development. sage.
- Richard e Boyatzis. 1998。转换定性信息: 主题分析和代码开发。
- [22] Virginia Braun and Victoria Clarke. 2012. Thematic analysis. (2012). 弗吉尼亚·布劳恩和维多利亚·克拉克. 2012。主题分析。(2012)。
- [23] Amy Brown, Victoria A Mountford, and Glenn Waller. 2013. Is the therapeutic alliance overvalued in the treatment of eating disorders? *International Journal of Eating Disorders* 46, 8 (2013), 779–782.
- Amy Brown, Victoria a Mountford, and Glenn Waller 艾米·布朗, 维多利亚·a·芒福德, 格伦·沃勒. 2013 年。治疗联盟在治疗进食障碍方面是否被高估? 国际饮食失调杂志 46,8(2013) , 779-782。
- [24] Rick Busselle and Helena Bilandzic. 2008. Fictionality and perceived realism in experiencing stories: A model of narrative comprehension and engagement. *Communication Theory* 18, 2 (2008), 255–280.
- Rick Busselle 和 Helena Bilandzic. 2008 年。体验故事中的虚构性和感知现实主义: 叙事理解和参与的模型。传播理论 18,2(2008) , 255-280。
- [25] Rick Busselle and Helena Bilandzic. 2009. Measuring narrative engagement. *Media Psychology* 12, 4 (2009), 321–347.
- 里克·巴塞爾(Rick Busselle)和海伦娜·比兰泽克(Helena Bilandzic). 2009。测量叙事参与度。《媒体心理学》(Media Psychology)12,4(2009) , 321-347。
- [26] Per Carlbring, Gerhard Andersson, Pim Cuijpers, Heleen Riper, and Erik Hedman-Lagerlöf. 2018. Internet-based vs. face-to-face cognitive behavior therapy for psy-chiatric and somatic disorders: an updated systematic review and meta-analysis. *Cognitive behaviour therapy* 47, 1 (2018), 1–18.
- Per Carlbring, Gerhard Andersson, Pim Cuijpers, Heleen Riper, and Erik Hedman-Lagerlöf. 2018 年。基于互联网与面对面认知行为疗法治疗精神疾病和躯体疾病: 更新的系统综述和荟萃分析。认知行为疗法 47,1(2018) , 1-18。
- [27] Per Carlbring, Susanna Bohman, Sara Brunt, Monica Buhrman, Bengt E Westling, Lisa Ekselius, and Gerhard Andersson. 2006. Remote treatment of panic disorder: a randomized trial of internet-based cognitive behavior therapy supplemented with telephone calls. *American Journal of Psychiatry* 163, 12 (2006), 2119–2125.
- Per Carlbring, Susanna Bohman, Sara Brunt, Monica Buhrman, Bengt e Westling, Lisa Ekselius, and Gerhard anderson. 2006. 远程治疗惊恐障碍: 一项基于互联网的认知行为疗法的随机试验, 辅以电话治疗。美国精神病学杂志 163,12(2006) , 2119-2125。
- [28] Vanessa Wan Sze Cheng, Tracey Davenport, Daniel Johnson, Kellie Vella, and Ian B Hickie. 2019. Gamification in apps and technologies for improving mental health and well-being: systematic review. *JMIR mental health* 6, 6 (2019), e13717.
- Vanessa Wan Sze Cheng Tracey Davenport Daniel Johnson Kellie Vella 和 Ian b Hickie. 2019 年。Gamification in apps and technologies for improve mental health and well-being: systematic review 改善心理健康和幸福的应用程序和技术: 系统综述。JMIR 心理健康 6,6(2019) , e13717。
- [29] Vanessa Wan Sze Cheng, Tracey A Davenport, Daniel Johnson, Kellie Vella, Jo Mitchell, and Ian B Hickie. 2018. An app that incorporates gamification, mini-games, and social connection to improve men's mental health and well-being (MindMax): participatory design process. *JMIR mental health* 5, 4 (2018), e11068.
- Vanessa Wan Sze Cheng, Tracey a Davenport, Daniel Johnson, Kellie Vella, Jo Mitchell, and Ian b Hickie. 2018 年。一个集游戏化、迷你游戏和社会联系于一体的应用程序, 以改善男性的心理健康和幸福(MindMax): 参与式设计过程。JMIR 心理健康 5,4(2018) , e11068。
- [30] Helen Christensen, Kathleen M Griffiths, and Ailsa Korten. 2002. Web-based cognitive behavior therapy: analysis of site usage and changes in depression and anxiety scores. *Journal of medical Internet research* 4, 1 (2002), e3.
- Helen Christensen Kathleen m Griffiths 和 Ailsa Korten. 2002 年。基于网络的认知行为疗法: 分析网站使用情况以及抑郁和焦虑评分的变化。医学互联网研究杂志 4,1(2002) , e3。
- [31] Marina Christoforou, José Andrés Sáez Fonseca, and Elias Tsakanikos. 2017. Two novel cognitive behavioral therapy-based mobile apps for agoraphobia: randomized controlled trial. *Journal of medical Internet research* 19, 11 (2017), e398.
- Marina Christoforou, José Andrés Sáez Fonseca, and Elias Tsakanikos. 2017 年。两个新颖的基于认知行为疗法的广场恐惧症移动应用程序: 随机对照试验。医学互联网研究杂志 19,11(2017) , e398。
- [32] Benjamin F Crabtree. 1999. Doing qualitative research. sage.
- 本杰明 f 螃蟹树. 1999。做质性研究。圣人。

- [33] Brian Cugelman. 2013. Gamification: what it is and why it matters to digital health behavior change developers. *JMIR serious games* 1, 1 (2013), e3.
Brian Cugelman.2013 年. Gamification: 它是什么以及为什么它对数字健康行为改变开发者很重要. *JMIR 严肃游戏* 1,1(2013) , e3.
- [34] Pim Cuijpers, Tara Donker, Annetie van Straten, J Li, and Gerhard Andersson. 2010. Is guided self-help as effective as face-to-face psychotherapy for depression and anxiety disorders? A systematic review and meta-analysis of comparative outcome studies. *Psychological medicine* 40, 12 (2010), 1943–1957.
Pim Cuijpers, Tara Donker, annmike van Straten, j Li, and Gerhard Andersson.2010 年. 指导性自助和面对面心理治疗一样有效吗? 比较结果研究的系统综述和荟萃分析. *心理医学* 40,12(2010) , 1943-1957.
- [35] Edward L Deci and Richard M Ryan. 2012. Self-determination theory. (2012).
Edward I Deci and Richard m Ryan. 2012. self-determination theory. (2012).
- [36] Steven Denisevicz and Jichen Zhu. 2019. Interweaving Narrative and Gameplay to Cultivate Empathy for Anxiety and Depression. In *Extended Abstracts of the Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts*. 247–252.
- Steven Denisevicz and Jichen Zhu 史蒂文·丹尼塞维茨和朱季辰. 2019 年. 交互叙事和游戏培养对焦虑和抑郁的同理心. 年度计算机与人类互动研讨会的扩展摘要. 247-252.
- [37] Sebastian Deterding, Dan Dixon, Rilla Khaled, and Lennart Nacke. 2011. From game design elements to gamefulness: defining "gamification". In *Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments*. 9–15.
Sebastian Deterding Dan Dixon Rilla Khaled and Lennart Nacke. 2011 年. 从游戏设计元素到游戏性: 定义“游戏化”。在《第 15 届国际学术 MindTrek 会议记录: 展望未来媒体环境》中. 9-15.
- [38] T Donker, S Van Esveld, N Fischer, and A Van Straten. 2018. OPhobia—towards a virtual cure for acrophobia: study protocol for a randomized controlled trial. *Trials* 19, 1 (2018), 1–11.
Donker, s Van Esveld, n Fischer, and a Van Straten.2018 年. OPhobia-向恐高症的虚拟治愈迈进: 随机对照试验的研究方案. 审判 19,1(2018) , 1-11.
- [39] Liesje Donkin, Ian B Hickie, Helen Christensen, Sharon L Naismith, Bruce Neal, Nicole L Cockayne, and Nick Glozier. 2013. Rethinking the dose-response relationship between usage and outcome in an online intervention for depression: randomized controlled trial. *Journal of medical Internet research* 15, 10 (2013), e231.
Liesje Donkin Ian b Hickie Helen Christensen Sharon I Naismith Bruce Neal Nicole I Cockayne 还有 Nick Glozier. 2013 年. 重新思考抑郁症在线干预的剂量-反应关系: 随机对照试验. *医学互联网研究杂志* 15,10(2013) , e231.
- [40] Angel Enrique, Jorge E Palacios, Holly Ryan, and Derek Richards. 2019. Exploring the relationship between usage and outcomes of an internet-based intervention for individuals with depressive symptoms: secondary analysis of data from a randomized controlled trial. *Journal of medical Internet research* 21, 8 (2019), e12775.
Angel Enrique, Jorge e Palacios, Holly Ryan, and Derek Richards.2019 年. 探索基于互联网的抑郁症状个体干预的使用和结果之间的关系: 随机对照试验数据的二次分析. *医学互联网研究杂志* 21,8(2019) , e12775.
- [41] Gunther Eysenbach. 2005. The law of attrition. *Journal of medical Internet research* 7, 1 (2005), e402.
巩特尔·艾森巴赫. 2005. 消耗定律. *医学互联网研究杂志* 7,1(2005) , 第 402 页。
- [42] Peter Farvolden, Eilenna Denisof, Peter Selby, R Michael Bagby, and Laura Rudy. 2005. Usage and longitudinal effectiveness of a Web-based self-help cognitive behavioral therapy program for panic disorder. *Journal of medical Internet research* 7, 1 (2005), e129.
Peter Farvolden, Eilenna Denisof, Peter Selby, r Michael Bagby, and Laura Rudy.2005 年. 基于网络的自助认知行为治疗恐慌症项目的使用和纵向有效性. *医学互联网研究杂志* 7,1(2005) , e129.
- [43] Christoph Flückiger, Aaron C Del Re, Bruce E Wampold, and Adam O Horvath. 2018. The alliance in adult psychotherapy: A meta-analytic synthesis. *Psychother-apy* 55, 4 (2018), 316.
克里斯托弗·弗利克, 亚伦·德尔雷, 布鲁斯·万波德, 还有亚当·奥·霍瓦斯. 2018 年. 成人心理治疗联盟: 元分析综合. *Psychother-apy* 55,4(2018) , 316.
- [44] Elaine Iljon Foreman and Clair Pollard. 2016. *Cognitive Behavioural Therapy (CBT): Your Toolkit to Modify Mood, Overcome Obstructions and Improve Your Life*. Icon Books.
伊莱恩·伊尔乔恩·福尔曼和克莱尔·波拉德. 2016 年. 认知行为疗法(CBT): 你的工具包来调节情绪, 克服障碍, 改善你的生活. 图文书籍。
- [45] Lauren G Fox and Drew Barnes. 2016. BoosterBuddy: using gamification as a compensatory strategy for motivational deficits. *Psychiatric Services* 67, 1 (2016), 141–142.
Lauren g Fox 和 Drew Barnes. 2016 年. BoosterBuddy: 使用游戏化作为动机缺陷的补偿策略. *精神病服务* 67,1(2016) , 141-142.
- [46] Judith Gellatly, Peter Bower, Sue Hennessy, David Richards, Simon Gilbody, and Karina Lovell. 2007. What makes self-help interventions effective in the management of depressive symptoms? Meta-analysis and meta-regression. *Psychological medicine* 37, 9 (2007), 1217–1228.
Judith Gellatly, Peter Bower, Sue Hennessy, David Richards, Simon Gilbody 和 Karina Lovell. 2007 年. 是什么使得自助干预在抑郁症状的治疗中有效? Meta 分析和 meta 回归. *心理医学* 37,9(2007) , 1217-1228.
- [47] SAH Gerhards, TA Abma, Arnoud Arntz, LE De Graaf, SMAA Evers, MJH Huibers, and GAM Widdershoven. 2011. Improving adherence and effectiveness of computerised cognitive behavioural therapy without support for depression: a qualitative study on patient experiences. *Journal of affective disorders* 129, 1-3 (2011), 117–125.
SAH Gerhards TA Abma Arnoud Arntz LE De Graaf SMAA Evers MJH Huibers 还有 GAM Widdershoven. 2011 年. 改善计算机认知行为疗法的依从性和有效性, 而不支持抑郁症: 对患者经验的定性研究. *情感障碍杂志* 129,1-3(2011) , 117-125.
- [48] Melanie C Green and Timothy C Brock. 2000. The role of transportation in the persuasiveness of public narratives. *Journal of personality and social psychology* 79, 5 (2000), 701.
梅兰妮·c·格林和蒂莫西·c·布洛克. 2000 年. 交通运输在公共叙事的说服力中的作用. *人格与社会心理学杂志* 79,5(2000) , 701.
- [49] Claire Henderson, Sara Evans-Lacko, and Graham Thornicroft. 2013. Mental illness stigma, help seeking, and public health programs. *American journal of public health* 103, 5 (2013), 777–780.
Claire Henderson Sara Evans-Lacko 和 Graham Thornicroft. 2013 年. 精神疾病的耻辱感, 寻求帮助和公共健康计划. *美国公共卫生杂志* 103,5(2013) , 777-780.
- [50] Laura Hillier. 2018. Exploring the nature of the therapeutic alliance in technology-based interventions for mental health problems. Ph. D. Dissertation. Lancaster University (United Kingdom).
劳拉·希利尔. 2018 年. 探索以技术为基础的心理健康问题干预治疗联盟的性质. 博士论文. 兰卡斯特大学(英国)。
- [51] Zita Hilvert-Bruce, Pieter J Rossouw, Nora Wong, Matthew Sunderland, and Gavin Andrews. 2012. Adherence as a determinant of effectiveness of internet cognitive behavioural therapy for anxiety and depressive disorders. *Behaviour research and therapy* 50, 7-8 (2012), 463–468.
Zita Hilvert-Bruce Pieter j Rossouw Nora Wong Matthew Sunderland 和 Gavin Andrews. 2012 年. 依从性作为网络认知行为疗法治疗焦虑和抑郁障碍有效性的决定因素. *行为研究和治疗* 50,7-8(2012) , 463-468.
- [52] Chris Hollis, Stephanie Sampson, Lucy Simons, E Bethan Davies, Rachel Churchill, Victoria Betton, Debbie Butler, Kathy Chapman, Katherine Easton, Toto Anne Gronlund, et al. 2018. Identifying research priorities for digital technology in mental health care: results of the James Lind Alliance Priority Setting Partnership. *The Lancet Psychiatry* 5, 10 (2018), 845–854.
Chris Hollis, Stephanie Sampson, Lucy Simons, e Bethan Davies, Rachel Churchill, Victoria Betton, Debbie Butler, Kathy Chapman, Katherine Easton to Anne Gronlund et al. 2018. 确定数字技术在心理健康护理中的研究优先级: 詹姆斯·林德联盟优先级设置伙伴关系的结果. *柳叶刀精神病学* 5,10(2018) , 845-854.
- [53] Steven D Hollon and Philip C Kendall. 1980. Cognitive self-statements in depression: Development of an automatic thoughts questionnaire. *Cognitive therapy and research* 4, 4 (1980), 383–395.
Steven d Hollon 和 Philip c Kendall. 1980 年. 抑郁症中的认知自我陈述: 自动思维问卷的开发. *认知疗法和研究* 4,4(1980) , 383-395.
- [54] Anna Huguet, Sanjay Rao, Patrick J McGrath, Lori Wozney, Mike Wheaton, Jill Conrod, and Sharlene Rozario. 2016. A systematic review of cognitive behavioral therapy and behavioral activation apps for depression. *PLoS one* 11, 5 (2016), e0154248.
Anna Huguet, Sanjay Rao, Patrick j McGrath, Lori Wozney, Mike Wheaton, Jill Conrod, and Sharlene Rozario.2016 年. 抑郁症的认知行为疗法和行为激活应用程序的系统综述. *PLoS one* 11,5(2016) , e0154248.

Woodstock '18, June 03–05, 2018, Woodstock, NY
Woodstock'18, June 03-05,2018, Woodstock, NY 伍德斯托克 2018 年 6 月 3 日至 5 日, 纽约

- [55] Daniel Johnson, Sebastian Deterding, Kerri-Ann Kuhn, Aleksandra Staneva, Stoyan Stoyanov, and Leanne Hides. 2016. Gamification for health and wellbeing: A systematic review of the literature. *Internet interventions* 6 (2016), 89–106.
- Daniel Johnson, Sebastian Deterding, Kerri-Ann Kuhn, Aleksandra Staneva, Stoyan Stoyanov, and Leanne Hides. 2016 年. Gamification for health and wellbeing: a systematic review of the literature 健康与幸福的游戏化: 文献系统综述. 互联网干预 6(2016), 89-106.
- [56] A Kapungwe, Sara Cooper, J Mwanza, L Mwape, A Sikwese, R Kakuma, Christo-pher Lund, AJ Fisher, et al. 2010. Mental illness-stigma and discrimination in Zambia. *African Journal of Psychiatry* 13, 3 (2010).
- A Kapungwe, Sara Cooper, j Mwanza, l Mwape, a Sikwese, r Kakuma, r Kakuma, chris-pher Lund, AJ fisher, et al. 2010.精神疾病-赞比亚的耻辱和歧视. 非洲精神病学杂志 13,3(2010).
- [57] Eirini Karyotaki, Heleen Riper, Jos Twisk, Adriaan Hoogendoorn, Annet Kleiboer, Adriana Mira, Andrew Mackinnon, Björn Meyer, Cristina Botella, Elizabeth Littlewood, et al. 2017. Efficacy of self-guided internet-based cognitive behavioral therapy in the treatment of depressive symptoms: a meta-analysis of individual participant data. *JAMA psychiatry* 74, 4 (2017), 351–359.
- Eirini Karyotaki, Heleen Riper, Jos Twisk, adrian Hoogendoorn, Annet Kleiboer, Adriana Mira, Andrew Mackinnon, Björn Meyer, Cristina Botella, Elizabeth Littlewood, et al. 2017.基于互联网的自我引导认知行为疗法治疗抑郁症状的效果: 个体参与者数据的荟萃分析. JAMA 精神病学 74,4(2017), 351-359.
- [58] Saskia Marion Kelders, Marion Sommers-Spijkerman, and Jochem Goldberg. 2018. Investigating the direct impact of a gamified versus nongamified well-being intervention: an exploratory experiment. *Journal of medical Internet research* 20, 7 (2018), e247.
- Saskia Marion Kelders Marion Sommers-Spijkerman 还有 Jochem Goldberg. 2018 年. 调查游戏化与非游戏化幸福感干预的直接影响: 一个探索性实验. 医学互联网研究杂志 20,7(2018), e247.
- [59] David Kessler, Glyn Lewis, Surinder Kaur, Nicola Wiles, Michael King, Scott Weich, Debbie J Sharp, Ricardo Araya, Sandra Hollinghurst, and Tim J Peters. 2009. Therapist-delivered internet psychotherapy for depression in primary care: a randomised controlled trial. *The Lancet* 374, 9690 (2009), 628–634.
- David Kessler Glyn Lewis Surinder Kaur Nicola Wiles Michael King Scott Weich Debbie j Sharp Ricardo Araya Sandra Hollinghurst and Tim j Peters. 2009. Therapist-delivered internet psychotherapy for depression in primary care: a randomised controlled trial. The Lancet 374, 9690 (2009), 628-634. 二零零九年. 治疗师-提供网络心理疗法治疗初级保健中的抑郁症: 一项随机对照试验. 柳叶刀 374,9690(2009), 628-634.
- [60] Ronald C Kessler, Patricia Berglund, Olga Demler, Robert Jin, Kathleen R Merikan-gas, and Ellen E Walters. 2005. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of general psychiatry* 62, 6 (2005), 593–602.
- Ronald c Kessler, Patricia Berglund, Olga Demler, Robert Jin, Kathleen r Merikan-gas, and Ellen e Walters.2005 年. 国家合并症调查复制中 DSM-IV 障碍的终生患病率和发病年龄分布. 普通精神病学档案 62,6(2005), 593-602.
- [61] Dominic King, Felix Greaves, Christopher Exeter, and Ara Darzi. 2013. 'Gamif-cation': Influencing health behaviours with games. *多米尼克·金, 菲利克斯·格里夫斯, 克里斯托弗·埃克塞特, 阿拉·达兹. 2013. 'Gamif-cation': 用游戏影响健康行为.*
- [62] Eric Klinger. 1969. Development of imaginative behavior: Implications of play for a theory of fantasy. *Psychological Bulletin* 72, 4 (1969), 277.
- 埃里克·克林格. 1969 年. 想象行为的发展: 游戏对幻想理论的启示. 心理学公报 72,4(1969), 277.
- [63] Rachel Kornfeld, Renwen Zhang, Jennifer Nicholas, Stephen M Schueller, Scott A Cambo, David C Mohr, and Madhu Reddy. 2020. "Energy is a Finite Resource": Designing Technology to Support Individuals across Fluctuating Symptoms of Depression. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. 1–17.
- Rachel Kornfeld Renwen Zhang Jennifer Nicholas Stephen m Schueller Scott a Cambo David c Mohr Madhu Reddy.2020 年能源是一种有限的资源: 设计技术, 支持个人跨越抑郁症的波动症状. 2020 年 CHI 计算机系统中的人类因素会议记录. 1-17.
- [64] Kurt Kroenke, Robert L Spitzer, and Janet BW Williams. 2001. The PHQ-9: validity of a brief depression severity measure. *Journal of general internal medicine* 16, 9 (2001), 606–613.
- Kurt Kroenke, Robert l Spitzer, and Janet BW Williams 库尔特·克伦克, 罗伯特·L·斯皮策, 珍妮特·威廉姆斯. 2001 年. PHQ-9: 短暂抑郁严重程度测量的有效性. 普通内科杂志 16,9(2001), 606-613.
- [65] Cameron Lister, Joshua H West, Ben Cannon, Tyler Sax, and David Brodegard. 2014. Just a fad? Gamification in health and fitness apps. *JMIR serious games* 2, 2 (2014), e9.
- Cameron Lister Joshua h West Ben Cannon Tyler Sax and David Brodegard. 2014 年. 只是一时兴起? Gamification in health and fitness apps 健康和身体应用中的游戏化. JMIR 严肃游戏 2,2(2014), e9.
- [66] Daniel J Martin, John P Garske, and M Katherine Davis. 2000. Relation of the therapeutic alliance with outcome and other variables: a meta-analytic review. *Journal of consulting and clinical psychology* 68, 3 (2000), 438.
- 丹尼尔·j·马丁, 约翰·p·加斯克, m 凯瑟琳·戴维斯. 2000 年. 治疗联盟与结果和其他变量的关系: 荟萃分析综述. 咨询和临床心理学杂志 68,3(2000), 438.
- [67] Laura Martinengo, Anne-Claire Stona, Konstadina Griva, Paola Dazzan, Carmine Maria Pariente, Florian von Wangenheim, Josip Car, et al. 2021. Self-guided cognitive behavioral therapy apps for depression: systematic assessment of features, functionality, and congruence with evidence. *Journal of medical internet research* 23, 7 (2021), e27619.
- 劳拉·马丁内戈, 安妮-克莱尔·斯托纳, 康斯塔蒂娜·格里瓦, 保拉·达赞, 卡麦·玛丽亚·帕里安特, 弗洛里安·冯·旺根海姆, 约瑟普·卡尔等, 2021 年. 抑郁症的自我引导认知行为疗法应用: 对特征、功能和证据一致性的系统评估. 医学互联网研究杂志 23,7(2021), e27619.
- [68] Alexander Milof, Arvid Marklund, and Per Carlbring. 2015. The challenger app for social anxiety disorder: New advances in mobile psychological treatment. *Internet interventions* 2, 4 (2015), 382–391.
- Alexander Milof, Arvid Marklund, and Per Carlbring 亚历山大·米洛夫, 阿维德·马克伦德, 佩尔·卡尔布莱恩. 2015 年. 社交焦虑症的挑战者应用: 移动心理治疗的新进展. 互联网干预 2,4(2015), 382-391.
- [69] Joanna Milward, Paolo Deluca, Colin Drummond, Rod Watson, Jacklyn Dunne, and Andreas Kimergård. 2017. Usability testing of the BRANCH smartphone app designed to reduce harmful drinking in young adults. *JMIR mHealth and uHealth* 5, 8 (2017), e109.
- Joanna Milward Paolo Deluca Colin Drummond Rod Watson Jacklyn Dunne 还有 Andreas Kimergård. 2017 年. BRANCH 智能手机应用程序的可用性测试, 旨在减少年轻人的有害饮酒. JMIR mHealth and uHealth 5,8(2017), e109.
- [70] Christine Moberg, Andrea Niles, and Dale Beermann. 2019. Guided self-help works: randomized waitlist controlled trial of Pacifica, a mobile app integrating cognitive behavioral therapy and mindfulness for stress, anxiety, and depression. *Journal of medical Internet research* 21, 6 (2019), e12556.
- Christine Moberg, Andrea Niles, and Dale Beermann 克里斯汀·莫伯格, 安德里亚·奈尔斯, 戴尔·比尔曼. 2019 年. 指导性自助工作: Pacifica 的随机等待名单对照试验, 这是一个集认知行为疗法和正念治疗压力、焦虑和抑郁的移动应用程序. 医学互联网研究杂志 21,6(2019), e12556.
- [71] Scott Nicholson. 2015. A recipe for meaningful gamification. In *Gamification in education and business*. Springer, 1–20.
- Scott Nicholson. 2015. 有意义的游戏化的秘诀. In Gamification In education and business. Springer, 1-20.
- [72] Bunmi O Olatunji, Brooke Y Kaufman, Sari Meltzer, Michelle L Davis, Jasper AJ Smits, and Mark B Powers. 2014. Cognitive-behavioral therapy for hypochondriasis/health anxiety: a meta-analysis of treatment outcome and moderators. *Behaviour research and therapy* 58 (2014), 65–74.
- Bunmi o Olatunji, Brooke y Kaufman, Sari Meltzer, Michelle l Davis, Jasper AJ Smits, and Mark b Powers.2014 年. 认知行为疗法治疗疑病症/健康焦虑: 治疗结果和调节因子的荟萃分析. 行为研究和治疗 58(2014), 65-74.
- [73] Louise E Parker and Mark R Lepper. 1992. Effects of fantasy contexts on children's learning and motivation: Making learning more fun. *Journal of personality and social psychology* 62, 4 (1992), 625.
- Louise e Parker 和 Mark r Lepper. 1992 年. 幻想环境对儿童学习和动机的影响: 使学习更有趣. 人格与社会心理学杂志 62,4(1992), 625.
- [74] Mandar Patwardhan, Ryan Stoll, Derek B Hamel, Ashish Amresh, Kevin A Gary, and Armando Pina. 2015. Designing a mobile application to support the indicated prevention and early intervention of childhood anxiety. In *Proceedings of the conference on Wireless Health*. 1–8.
- Mandar Patwardhan, Ryan Stoll, Derek b Hamel, Ashish Amresh, Kevin a Gary and Armando Pina. 2015 年. 设计一个移动应用程序来支持儿童焦虑的指示性预防和早期干预. 在无线健康会议的会议记录中. 1-8.
- [75] Martin Pedersen. 1995. Storytelling and the Art of Teaching. *Forum* 33 (01 1995).
- 马丁·彼得森. 1995. 讲故事与教学艺术. 论坛 33(011995).
- [76] Richard E Petty and John T Cacioppo. 1986. The elaboration likelihood model of persuasion. In *Communication and persuasion*. Springer, 1–24.
- 理查德·e·佩蒂和约翰·t·卡乔波. 1986 年. 说服的思考可能性模式. 在沟通和说服中. 斯普林格, 1-24.
- [77] Christine M Ricci and Carole R Beal. 2002. The effect of interactive media on children's story memory. *Journal of Educational Psychology* 94, 1 (2002), 138.
- Christine m Ricci and Carole r Beal.2002 年. 互动媒体对儿童故事记忆的影响. 教育心理学杂志 94,1(2002), 138.
- [78] Richard M Ryan and Edward L Deci. 2002. Overview of self-determination theory: An organismic dialectical perspective. *Handbook of self-determination research* 2 (2002), 3–33.
- 理查德 m 瑞安和爱德华 l 德西. 2002 年. Overview of self-determination theory: An organic dialectical perspective 自决理论概述: 一个有机的辩证观点. 自决研究手册 2(2002), 3-33.

- [79] Michael Sailer, Jan Ulrich Hense, Sarah Katharina Mayr, and Heinz Mandl. 2017. How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior* 69 (2017), 371–380.
- Michael Sailer Jan Ulrich Hense Sarah Katharina Mayr 和 Heinz Mandl. 2017 年。游戏化的动机：一项关于特定游戏设计元素对心理需求满意度影响的实验研究。《计算机在人类行为》69(2017)，371-380。
- [80] Lamyae Sardi, Ali Idri, and José Luis Fernández-Alemán. 2017. A systematic review of gamification in e-Health. *Journal of biomedical informatics* 71 (2017), 31–48.
- Lamyae Sardi Ali Idri 和 José Luis Fernández-Alemán. 2017 年。电子健康游戏化的系统综述。《生物医学信息学杂志》71(2017)，31-48。
- [81] Roger C Schank. 1995. *Tell me a story: Narrative and intelligence*. Northwestern University Press.
- Roger c Schank, 1995. 《给我讲个故事：叙事与情报》，西北大学出版社。
- [82] Robert L Spitzer, Kurt Kroenke, Janet BW Williams, and Bernd Löwe. 2006. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine* 166, 10 (2006), 1092–1097.
- Robert l Spitzer Kurt Kroenke Janet BW Williams 和 Bernd lowe. 2006 年。一个评估广泛性焦虑症的简单方法：GAD-7。《Jama 内科报》166,10(2006)，1092-1097。
- [83] Katarzyna Stawarz, Chris Preist, Debbie Tallon, Nicola Wiles, David Coyle, et al. 2018. User experience of cognitive behavioral therapy apps for depression: an analysis of app functionality and user reviews. *Journal of medical Internet research* 20, 6 (2018), e10120.
- Katarzyna Stawarz, Chris Preist, Debbie Tallon, Nicola Wiles, David Coyle, et al. 抑郁症认知行为治疗应用的用户体验：应用功能分析和用户评论。《医学互联网研究杂志》20,6(2018)，e10120。
- [84] Ruthann C Thomas and Lynn Hasher. 2006. The influence of emotional valence on age differences in early processing and memory. *Psychology and aging* 21, 4 (2006), 821.
- Ruthann c Thomas 和 Lynn Hasher. 2006 年。情绪效价对早期加工和记忆中年龄差异的影响。《心理学与年龄》21,4(2006)，821。
- [85] Nicholas J Todd, Steven H Jones, and Fiona A Lobban. 2013. What do service users with bipolar disorder want from a web-based self-management intervention? A qualitative focus group study. *Clinical psychology & psychotherapy* 20, 6 (2013), 531–543.
- Nicholas j Todd, Steven h Jones, and Fiona a Lobban 尼古拉斯·j·托德，史蒂文·h·琼斯，菲奥娜·洛班。2013 年。患有躁郁症的服务用户希望从基于网络的自我管理干预中得到什么？定性焦点小组研究。《临床心理学与心理治疗》20,6(2013)，531-543。
- [86] John Torous, Jessica Lipschitz, Michelle Ng, and Joseph Firth. 2020. Dropout rates in clinical trials of smartphone apps for depressive symptoms: a systematic review and meta-analysis. *Journal of affective disorders* 263 (2020), 413–419.
- John Torous Jessica Lipschitz Michelle Ng 和 Joseph Firth. 2020 年。智能手机应用程序治疗抑郁症临床试验中的辍学率：系统综述和荟萃分析。《情感障碍杂志》263(2020)，413-419。
- [87] Hailey Tremain, Carla McEnery, Kathryn Fletcher, and Greg Murray. 2020. The therapeutic alliance in digital mental health interventions for serious mental illnesses: narrative review. *JMIR mental health* 7, 8 (2020), e17204.
- Hailey Tremain, Carla McEnery, Kathryn Fletcher, and Greg Murray. 2020 年。严重精神疾病数字化心理健康干预的治疗联盟：叙述性评论。《JMIR 心理健康》7,8(2020)，e17204。
- [88] Hidde van der Meulen, Darragh McCashin, Gary O'Reilly, and David Coyle. 2019. Using computer games to support mental health interventions: naturalistic deployment study. *JMIR mental health* 6, 5 (2019), e12430.
- 躲起来 van der Meulen Darragh McCashin Gary o'reilly 和 David Coyle. 2019 年。利用电脑游戏支持心理健康干预：自然部署研究。《JMIR 心理健康》6,5(2019)，e12430。
- [89] Michael J Wells, Jesse J Owen, Laura W McCray, Laura B Bishop, Tracy D Eells, Gregory K Brown, Derek Richards, Michael E Thase, and Jesse H Wright. 2018. Computer-assisted cognitive-behavior therapy for depression in primary care: systematic review and meta-analysis. *The primary care companion for CNS disorders* 20, 2 (2018), 0–0.
- Michael j Wells Jesse j Owen Laura w McCray Laura b Bishop Tracy d Eells Gregory k Brown Derek Richards Michael e Thase 和 Jesse h Wright. 2018 年。计算机辅助认知行为疗法治疗初级保健中的抑郁症：系统综述和荟萃分析。《中枢神经系统疾病的初级保健伴侣》20,2(2018)，0-0。
- [90] Kevin Werbach and Dan Hunter. 2012. *For the win: How game thinking can revolutionize your business*. Wharton digital press.
- 凯文·韦尔巴赫和丹·亨特 2012. 获胜：游戏思维如何彻底改变你的生意。沃顿数字出版社。
- [91] Robyn Whittaker, Sally Merry, Karolina Stasiak, Heather McDowell, Ian Doherty, Matthew Shepherd, Enid Dorey, Varsha Parag, Shanthi Ameratunga, and Anthony Rodgers. 2012. MEMO—a mobile phone depression prevention intervention for adolescents: development process and postprogram findings on acceptability from a randomized controlled trial. *Journal of medical Internet research* 14, 1 (2012), e13.
- Robyn Whittaker Sally Merry Karolina Stasiak Heather McDowell Ian Doherty Matthew Shepherd Enid Dorey Varsha Parag Shanthi Ameratunga 还有 Anthony Rodgers. 2012 年。Memo——青少年手机抑郁预防干预：随机对照试验的发展过程和程序后结果。《医学互联网研究杂志》14,1(2012)，e13。
- [92] Renwen Zhang, Kathryn E. Ringland, Melina Paan, David C. Mohr, and Madhu Reddy. 2021. Designing for Emotional Well-being: Integrating Persuasion and Customization into Mental Health Technologies. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 1–13.
- 张仁文，林兰，潘美莲，莫尔，雷迪。2021 年。为情绪健康而设计：将说服和定制整合到心理健康技术中。2021 年计算机系统中的人为因素 CHI 会议记录。1-13。