Digital Programs for Promoting Mental Health Among Youth: A Comprehensive Review of Design, Content, and Effectiveness

Mental Health Literacy | Help-Seeking Behavior | Mindfulness | Resilience

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Abstract

This report provides an overview of evidence-based, digital preventive programs for supporting adolescents' mental health and mental health literacy. More specifically, for promoting resilience, mindfulness and help-seeking behavior, as well as bringing awareness to internal and external resources. The literature review will serve as a base for module development in the me_HeLi-D project. The report was written based on the systematic review and meta-analysis already conducted by Uni Graz (Wright et al., 2023). Relevant data relating to content and design were extracted and analyzed from studies showing efficacy (N = 18). Other literature was freely used in the introduction and discussion sections. The aim was to learn from prior and effective mental health interventions that used digital tools and to sum up realization strategies for content and design for the me_HeLi-D project.

INTRODUCTION

Adolescence is a period in which developing individuals attain the skills and competencies necessary to become productive and functioning adults (Barker, 2007). It is characterized by various changes (e.g. physical, socio-emotional), as well as cognitive and social development which results in the formation of identity and represents a critical point in human development (Slater & Bremner, 2017). Not only do the brains and bodies of adolescents change, but often also their social roles and responsibilities (Huang et al., 2019). Taking the above into account a connection can be made between the period of adolescence and the susceptibility to mental health concerns. This is also supported by data, as for example the WHO (2021) reports that one in seven adolescents aged between 10 and 19 years experiences a mental health related concern, but these are often left untreated. Meaning, there is a noticeable gap between individuals that do indeed receive support for their mental health and those who do not even though they require it. This is especially important considering that many cases of mental health issues or disorders in adulthood, such as anxiety and depression related disorders, have their onset in adolescence (Gibb et al., 2010; Kim-Cohen et al., 2003). Furthermore, the recent COVID-19 pandemic with its restrictive measures (lockdown measures, social isolation etc.) put into place to stop the spread of the SARS-COV-2 virus has further exacerbated concerns of a mental health decline among adolescents (Ford et al., 2021).

From a psychological perspective, the risk of mental health related concerns in adolescence can be mitigated by developing evidence-based preventive programs. Thus, the goal of prevention programs is to support mental health and wellbeing, as well as to provide adolescents with measures on how to seek-out help. According to Bluth et al. (2016) adolescence is a critical time for prevention and intervention. If mental health of adolescents is adequately supported, meaning supporting the mental health of the general adolescent population, as well as identifying those at risk for mental health concerns and/or experiencing the development of mental illness, then at least some of the effects of adolescence mental health issues that spillover to adulthood can be mitigated. Furthermore, as stated by Patafio et al. (2021), adolescents are at risk for mental illnesses because they can lack an understanding of common mental health problems and consequently fail to seek help. Thus, adolescents represent a wide and essential target group to which we can provide preventive measures and education in the field of mental health and which in turn can lead towards positive outcomes in adulthood.

A starting point for providing mental health support for adolescents is to develop and enhance their mental health literacy (MHL; Jorm et al., 1997). MHL gives adolescents the necessary knowledge in order to recognize mental health concerns in themselves, as well as in their social circles (e.g. friends and peer networks). As mental health is reflected in several domains (such as knowledge of mental illnesses, resilience, mindfulness, help-seeking behavior) mental health and mental health literacy interventions and programs typically focus on these domains. Previously, mental health interventions and programs have been delivered to adolescents in classrooms via in-person workshops or lectures (Carsley et al., 2018; Dray et al., 2017), but now with the advancement of technology digital prevention programs and tools are starting to arrive into focus (Bergin et al., 2020). The use of digital mental health programs that are delivered online is especially relevant to adolescents as they are according to data by UNICEF (2017) the “most connected age-group”. Thus, digital programs tailored to the unique needs of adolescents seem to be a highly relevant means of interventions that are in line with the specific needs and habits of adolescents.

The Erasmus+ project me_HeLi-D (Mental Health Literacy and Diversity. Enhancing Mental Health and Resilience through digital Resources for Youth) is focused on supporting the mental health of adolescents through developing and testing a digital online program. In order to develop our own digital program for adolescents that is evidence-based, we first aim to conduct a review of currently available programs/interventions that are delivered online in order to distill best practices that can be incorporated in the design of our own program/digital tool.

Thus, in line with the target group, the purpose of the present systematic literature review is to assess which available mental health programs that have a digital/online component have been shown to be effective in fostering mental health of adolescents. Specifically, we are interested in the content of these interventions and how the content was designed to be used in a digital program for adolescents aged between 12 to 18 years. Furthermore, as mental health can be fostered through the development of related domains such as resilience, mindfulness, and help-seeking behavior, the present review will also focus on how these domains were represented in the programs.

Mental health and mental health literacy

According to WHO (2022) mental health is defined as a state of well-being enabling individuals to cope with the stressors of daily life, realize their abilities, work and learn well, and contribute to their community. It is not just an absence of mental illness/ill health, but an integral component of overall health and well-being underpinning individual and collective abilities to make decisions, build relationships and shape the world we live in. Thus, mental health is a construct that highlights how well does the individual function in his/her environment and is a continuum rather than a category. This means that individuals have various degrees to their mental health and this can vary based on numerous factors (e.g. stress, resilience).

As pointed out by Patafio et al. (2021) a lack of understanding of common mental health problems contributes to the failure of seeking help for mental health concerns. This means that a necessary prerequisite for seeking help is possessing adequate knowledge on the topic and available means of providing help. Mental health as such is therefore directly linked to the construct of mental health literacy. Consequently, mental health literacy can be classified as one of the domains of mental health as MHL contributes to the overall understanding and levels of mental health in individuals.

MHL evolved from research focusing on health literacy (Clarke et al., 2021) and was first coined by Jorm et al. (1997) to refer to knowledge and beliefs about mental disorders which assists with their recognition, management or prevention. Moreover, if an individual has high levels of mental health literacy then he or she is equipped with the necessary knowledge to have an appropriate response to a mental health concern and seek-out professional help or provide support when needed. MHL involves the use of several skills (Jorm, 2012; Jorm et al., 1997): a) knowledge of prevention of mental disorders, b) recognition of a developing disorder in the individual, c) knowledge of help-seeking possibilities and treatments available, d) knowledge of effective self-help strategies for milder problems, and e) first aid skills to support others who are developing a mental disorder or are presently in a mental health crisis. However, as knowledge and skills are not enough to adequately respond to mental health concerns, Kutcher et al. (2016) expanded the original definition by adding several components to the construct. According to these authors, the current concept of mental health literacy includes the following: understanding how to obtain and maintain positive mental health; understanding mental disorders and their treatments, decreasing stigma associated with mental disorders; and enhancing help-seeking efficacy (knowing when and where to seek help and

developing competencies for improving one's mental health care and self-management capabilities. This definition is an extension of previous constructs, consistent with the construct of health literacy, includes the concept of stigma and expands self-help strategies to the broader construct of help-seeking efficacy. The understanding of stigma tied to seeking-help is especially worth noting as stigma related to mental health concerns and mental illness might refrain individuals from seeking-help or prevent them from finding and receiving adequate support.

Mental health literacy interventions provide a starting point for supporting mental health and MHL of adolescents. Clarke et al. (2021) defines the interventions as providing psychological education (psychoeducation) in regards to mental health with the aim of increasing adolescent's understanding on how to obtain and maintain positive mental health, decrease stigma in regards to mental illness, and enhance help-seeking knowledge, attitudes and behaviors. Thus, the aim of the interventions is to provide adolescents with practical knowledge and tools concerning their mental health. The need for mental health literacy interventions for students can be further justified by reflecting on the results from the study done by Hellström & Beckman (2021) in which young people expressed the need for receiving information about facing life's challenges without having to gain knowledge through their own lived experiences. Moreover, this means that the overall goal of mental health literacy interventions should be focused on prevention.

Concerning mental health literacy interventions, schools provide an excellent starting point for implementation. As adolescents spend a significant amount of time in school and as schools aim to teach life-long skills, it is only logical to provide programs to be implemented within a school setting. From a definition standpoint, school-based mental health literacy interventions are those conducted within school-settings (Ma et al., 2022) and can be conducted either by teachers or mental health professionals (e.g. psychologists). Interventions can take on various forms: from one-off interventions (Bentham et al., 2013) to curriculum-based (Milin et al., 2016). However, for the present review our focus lies on interventions that are primarily delivered online (such as mobile health/mHealth interventions, digital online programs) (Edridge et al., 2020).

Specific domains of mental health as components of mental health programs

MHL can be applied to several domains such as mindfulness, resilience, stress management, help-seeking behavior, prevention of common mental health concerns (such as depression and anxiety). In order to comprehensively support mental health, it is essential to put focus on these domains. Moreover, as the digital program in me_HeLi-D will span two modules (module 1: mindfulness, resilience, help-seeking; module 2: prevention of depression and anxiety) we aimed to conduct two literature reviews in the project. As the focus of the present review is on the topics of module 1, we will continue providing an overview into these domains. Topics of module 2 are covered in a separate systematic review.

Based on the previous paragraph, an overview of the mentioned domains follows, as well as pointing out their effectiveness for fostering mental health.

Mindfulness

Mindfulness meditation and practices have become a worldwide phenomenon in current times (Goldberg et al., 2022). Rooted in traditional Buddhist meditation, it is defined as paying attention in a particular way, on purpose, in the present moment, and nonjudgmentally (Kabat-Zinn, 2005).

According to Kabat-Zinn (2005) this particular way of attention nurtures greater awareness, clarity, and acceptance of present-moment reality. It takes on the notion that if we are not fully present in the moment, we may not only miss what is most valuable to our lives but also fail to realize the possibilities for our growth and transformation. It can be trained by practicing moment-to-moment awareness of emotions, body sensations and objects while accepting them as they are, without judging or trying to change anything (Maloney et al., 2016). For example, by doing exercises focusing on mindful breathing participants of mindfulness programs are taught to continually bring their attention or awareness back to the present-moment experiences and to notice thoughts or emotions as passing states while being able to return their attention to the mindfulness exercise when attention and awareness wander off (Tan, 2016). In general, mindfulness can be understood in two ways: either as state mindfulness or trait mindfulness. State mindfulness refers to it as a current state that is practiced in mindfulness meditation, while trait mindfulness refers to one's predisposition to be mindful in daily life (Kiken et al., 2015). There is also some evidence that increasing state mindfulness increases trait mindfulness (Kiken et al., 2015). In the literature various kinds of mindfulness practices are mentioned that can be categorized into meditative (focused attention meditation, open monitoring meditation, loving kindness meditation) and non-meditative (decentering, dechaining, empathetic perspective shifting, compassion training) (Amada & Shane, 2019).

Mindfulness enhances self-regulation, self-awareness, socio-cognitive skills, and a sense of agency to navigate internal and external challenges in adolescents which in turn may help them handle developmental obstacles (e.g. heightened emotionality and sensation seeking, immature cognitive regulation system) (Amada & Shane, 2019). For example, mindfulness teaches adolescents self-regulation which in turn can promote adaptive behavior (e.g. emotional control, emotional intelligence). Numerous literature emphasis the benefits of mindfulness practice on overall mental health and wellbeing (Dunning et al., 2018; Kallapiran et al., 2015; Kostova et al., 2019; McKeering & Hwang, 2019) or constructs associated with wellbeing (Cheang et al., 2019). However, more robust studies are needed as there are still methodological inconsistencies in study protocols and considerations for the generalizability of findings (Ruiz-Íñiguez et al., 2020). Along with this, research conducted on assessing school-based mindfulness interventions can still be considered in its infancy (Tudor et al., 2022). Based on this we can conclude that there is evidence for the effectiveness of mindfulness interventions, but more robust conclusions are needed especially in schools.

Resilience

Mental health also relates to how one responds and handles life's challenges, unexpected events, traumatic occurrences and uses coping strategies. This is reflected in the concept of resilience and it can be defined as the ability to bounce back from adversity, serious threat or trauma (Southwick & Charney, 2018). Masten (2001) described it as the achievement of good outcomes despite serious threats to adaptation or development. In other words, when an adverse life event triggers stress, resilience is the capacity to rebound from it (Blum & Blum, 2009). It can combat the development of mental illness and promote a state of well-being (Kaye-Kauderer et al., 2021) as it is the ability to maintain or regain mental health despite facing numerous adversities (Herrman et al., 2011). Moreover, it can mitigate negative consequences associated with emotional and behavioral problems (Huang et al., 2019).

According to Blum & Blum (2009) an individual response to an adverse event is moderated by both biological (primarily neurodevelopmental) and individual (cognitive and temperamental) factors that

contribute to both voluntary and involuntary responses to the stressor which in turn constitute the resilient response or lack of resilience. Many youths are unable to develop resilience on their own (Huang et al., 2019). However, as resilience is seen as a malleable trait (Masten, 2014) it can be supported through interventions such as mindfulness-based practice. Resilience and mindfulness "have a strong mechanical connection to one another conceptually" (Yuan, 2021, pp2). Wu et al. (2013) describe mindfulness as a determinant of resilience as with being more mindful is associated with higher resilience. Therefore, being aware of the "here and now" in mindfulness may enhance sensitivity to positive aspects of life, focus on developing a brighter outlook on life and experiencing more positive emotions more regularly which all in turn can help foster resilience (Kunzler et al., 2020). Thus, in me_HeLi-D we view resilience as a skill that can be developed by exercises based on mindfulness techniques.

Help-seeking behavior

One's ability to seek out help is directly associated with mental health literacy and mental health. Seeking help is a form of coping that relies on other people and is based on social relationships and interpersonal skills (Rickwood et al., 2005). Xu et al. (2018) state that help-seeking is needed for accessing appropriate care and improving mental health but individuals often delay or avoid seeking help. Often young people have a lack of willingness and knowledge on where to seek help (Hellström & Beckman, 2021) which prevents them from acting on a mental health concern. According to Barker (2007) it can refer to either formal (health facilities, youth centers, professional care providers, social institutions) or informal (e.g. family, friends) help for mental help concerns. Additionally, it can also refer to self-help as with the advancement of technology (e.g. computer mediated communication technologies) it is not necessary to consult an actual person to acquire help (Rickwood & Thomas, 2012). Moreover, it can be defined as any action or activity by individuals perceiving themselves as needing personal, psychological, emotional or social support, care or service with the purpose of addressing this need in a positive way (Barker, 2007). It can be conceptualized as a dynamic process that is characterized by a person's awareness of problems that may require help, followed by the onset of symptoms and need for support, the identification of sources of help, and ending with willingness to seek help and disclose relevant information (Rickwood et al., 2005).

Aguirre Velasco et al. (2020) have systematically identified several barriers to successful help-seeking behavior. The two most commonly found barriers were stigma and attitudes/beliefs about mental health services/providers. The authors also confirmed the fact that teens who need help the most are the least likely to search for it. Finally, the authors also highlighted so called structural barriers to help-seeking: costs, waiting times and transportation. In contrast, trusted relationships with gatekeepers (teachers, parents, GPs, health professionals) and previous positive help-seeking experiences were facilitators.

As stated by Patafio et al. (2021) the action of seeking-help for mental health problems is directly connected and facilitated with an individual's understanding and knowledge of mental health (i.e. mental health literacy) and their attitude toward mental ill-health. Lower MHL can often result in delayed help-seeking, which can have a negative impact on the prognosis of mental illness and its recovery (Jorm, 2012).

Xu et al. (2018) in a systematic review and meta-analysis study found help-seeking interventions to improve attitudes, intentions and behaviors to seek formal help for mental health problems in the general population. Interventions focused on improving mental health literacy or destigmatization

led to short term improvement. However, the meta-analysis showed no intervention effect for children and adolescents, but the authors suggest there is a clear need for interventions focusing on improving help-seeking behaviors for children and adolescents specifically. Furthermore, current evidence suggests that face to face interventions are more effective compared to online interventions in delivering behavioral changes, but only a few online interventions were included in the review. Similarly. Ma et al. (2022) systematically reviewed randomized control trials of school-based mental health literacy intervention and found no strong evidence of their effectiveness in improving help-seeking behavior. The authors point out that this might be due to heterogeneous content of interventions, characteristics of the participants and scarce use of standardized screening tools. Additionally, how interventions incorporate stigma towards seeking-help could be a key aspect of successful interventions. There is evidence that the interventions reviewed mostly reduce public stigma (i.e. the negative attitudes and discriminatory behaviors from others towards those with mental health concerns) but not self-stigma (i.e. the negative perception of self as a person with a mental health concern) while concluding that self-stigma is more closely associated to the act of help-seeking and is recommended to be addressed in future interventions. Based on this it is worth analyzing how help-seeking interventions can be successfully implemented in digital programs.

Supporting mental health and mental health literacy with digital tools

As previously mentioned the mental health of adolescents is of primary concern and it seems reasonable to reach them with digital interventions that mirror their daily habits and preferences (e.g. use of mobile phones, computers and the internet). By being the most connected age group (UNICEF, 2017) it is justifiable to create and implement interventions for adolescents that take advantage of their affiliation for online content and technology. Using digital tools and online resources in the field of mental health is a part of the so called e-mental health domain, but as there are various ways on how digital tools and online resources can be structured and used a distinction between them has to be made. Table 1 provides a brief overview on the differentiation of digital tools and variations in terminology based on the work summarized by Hollis et al. (2017). The table aims to clarify some of the terminology used related to MHL and digital programs.

Table 1

Overview of terminology used in connection to mental health literacy and digital tools

Term	Definition
eHealth	Electronic health: Internet-based delivery of healthcare or anything health-related that uses information and communications technology (ICT), incorporating computers or internet in its delivery.
Internet, online or web-based interventions	In most cases refers to a computerized program or service delivered through the internet (e.g. website), designed for creating a positive change in behavior or health status with varying levels of support (e.g. completely unguided, human-supported) given to the user.

Term	Definition
Computer-based or computer delivered interventions	Similar to internet-based interventions, but usually referring to a program delivered via a computer: intervention may be delivered through the internet or an offline computer program (e.g. CD-ROM or installed software). Includes psychoeducation and psychotherapy packages, “serious” games” and neurocognitive “brain training” interventions.
mHealth	Mobile-delivered health: A subdomain of eHealth focused on delivering healthcare-related information, interventions and monitoring through portable electronic/mobile devices and technologies, such as smartphones, tablets or wearable devices. Examples of mHealth for mental health include smartphone applications (“apps”), text/SMS delivered interventions and patient monitoring devices.
Digital health intervention (DHI)	Interventions that provide information, support and therapy (emotional, decisional, behavioral, neurocognitive) for physical and/or mental health problems by using a technological or digital platform (e.g. website, computer, mobile phone application - app, SMS, email, videoconferencing, wearable device).
Telehealth, telepsychiatry and telemedicine	Delivery of health services and treatment via telecommunications technology (e.g. videoconferencing, SMS, email). Includes online counseling and therapy that is delivered synchronous (e.g. real-time videoconferencing) or asynchronous (e.g. email or SMS).

Online interventions for supporting mental health possess various benefits, such as: its use is not restricted by time and space, cost-efficiency, available to be used by a large number of participants, diminishing individual barriers (reducing stigma, providing anonymity, integrating their use flexibly at users’ own pace) (Domhardt et al., 2021). Moreover, in the last few years many digital resources for supporting mental health have already been developed. However, one has to be careful when selecting and using digital resources as these are not always evidence-based. Torous et al. (2019) point out that a vast selection of digital resources (such as mobile apps) is already available, but these are not always formally evaluated or evidence-based in their development. Similarly, Domhardt et al. (2021) prepared a systematic review on the quality of mHealth apps and found that apps are poor in overall quality, lack science driven development and a strong methodological evaluation. Furthermore, as the authors point out, mental health interventions should be informed by theory when developed and evaluated in the form of randomized controlled trials (RCTs).

A strong case can be made for using high quality digital tools for supporting the mental health of adolescents. Kaess et al. (2021) point out that there is a clear value in evidence-based digital tools

that can be easily accessed and made available to young people. Examples of such preventive interventions using digital tools are SmartCoach (Haug et al., 2021) and Bite Back (Manicavasagar et al., 2014). Even though both SmartCoach and Bite Back both have the same overarching goal (i.e. supporting mental health) they differ in the method of delivery/intervention type. SmartCoach is a mobile-phone based program, while Bite Back is a web-based online program. Thus, a clear distinction based on the above Table 1 can be made between the two programs in regards to method of delivery/intervention type, but for the purpose of the present review both of these interventions are of interest as we aim to provide an overview of digital interventions irregards if it is mobile-based or online/website-based.

Gibson & Trnka (2020) make the case that professionals are increasingly using internet interventions to build on adolescents' willingness to use this medium. Authors agree (for example see Babbage et al., 2018; Kaess et al., 2021) that even though there is a clear need and justified usefulness for such interventions and the COVID-19 pandemic has further exacerbated the need for their use, they still largely remain untapped. For example one of the ways on how digital interventions can help support mental health of adolescents is by increasing the intentions of help-seeking behavior (Babbage et al., 2018; Kaess et al., 2021).

But what we have to keep in mind as researchers when designing and testing digital tools/online programs for adolescents is the fact that adolescents' knowledge and familiarity of online practices often surpasses that of researchers (Gibson & Trnka, 2020). Thus, in order to provide adolescents with digital tools that are aligned with their daily habits and preferences, it is necessary to include students as active participants in the process of designing a digital tool/intervention program. This means to recognise the value of working with the knowledge adolescents have on issues that concern them directly and promoting participatory methods of data collection and design of interventions (Thabrew et al., 2018; Wyn & Harris, 2004). For example, adolescents screened in focused groups reported that content related to mental health promotion should be made fun and deliver an interactive experience through the use of pictures, music, videos and games (Michel et al., 2019). By incorporating adolescents in intervention design, as well as being aligned with for recommendations for program development digital interventions with a participatory approach to development hold vast potential for supporting mental health.

Purpose of the literature report

This literature report aims to address currently available mental health programs that have a digital/online component and are focused on the following domains of mental health (mindfulness, resilience and help-seeking behavior) in adolescents aged between 12 and 18 years. In the present literature report we aim to address the following research questions:

1. Which evidence-based mental health programs/interventions with a digital component have been shown to be effective in supporting mental health of adolescents aged 12 to 18 years?
2. What was the content of these effective mental health programs/interventions?
3. How were these effective mental health programs/interventions designed (e.g. number of modules, duration of modules, types of activities, presentation of content)

The findings from the present literature report will be used to inform the development (content and design) of our own me_HeLi-D online mental health program for students.

METHODS

The studies reviewed for this report were extracted from the systematic review and meta-analysis by Wright et al. (2023) entitled *Interventions with Digital Tools for Mental Health Promotion among 11–18 Year Olds: A Systematic Review and Meta-Analysis,* published in the *Journal of Youth and Adolescence*. A detailed description of the method can be found in the corresponding article. The following section provides a brief summary of the methodological process.

Search strategy

The literature search followed a systematic approach and made use of the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (Page et al., 2021). The search was conducted using the electronic databases PubMed, PsycInfo, and The Cochrane Library.

Eligibility criteria

Strict inclusion criteria were determined: participants (children/adolescents aged between 11 to 18 years), intervention (preventive interventions with ≥50% digital delivery), study type (quantitative or mixed-methods studies), study design (controlled studies [CT) with pre-post comparison), publication (peer-reviewed; between 2000 and 2021), language (English).

Study selection process

Two searches were conducted: Search 1 (mid-May 2021) and search 2 (end-October 2021). In total, 27 studies matched the criteria and were reviewed. The Prisma flow chart (Page et al., 2021) of the study selection process and further details can be found in Wright et al. (2023). The following procedure was followed: (1) Database search and duplicate removal, (2) Screening with respect to inclusion/exclusion criteria, (3) Discussion of discrepancies (at abstract or full text level) within the team, (4) Data extraction.

Quality Assessment

To investigate the risk of bias in the included studies, the following tools were applied: the *Cochrane Risk of Bias Tool - RoB* (Higgins et al., 2022) for randomized controlled trials (RCTs) and the *Risk Of Bias In Non-Randomized Studies – ROBINS-I* (Sterne et al., 2016).

Analyses

A narrative synthesis and meta-analysis were applied to analyze the data. The narrative synthesis included providing an overview of key study characteristics, an in-depth analysis of the intervention activities, as well as an outline of their content and design. The meta-analysis was carried out using R (4.2.1 version).

RESULTS

In total, 27 studies were found eligible for inclusion. In a first step, the most relevant review findings by Wright et al. (2023) were summarized. In a second step, we undertook an in-depth analysis of interventions from studies that reported significant effects, regarding their relevant activities, content and design.

Summary of Review Findings

Narrative Synthesis

Study characteristics. Out of the 27 included studies, 15 (56%) reported significant between-group effects favoring the intervention group (IG) and 3 (11%) reported significant within group-effects. The remaining studies (9/33%) did not reach levels of significance and were thus not included into the in-depth analysis in Table 4. Almost two thirds (17/63%) of the reviewed interventions were implemented in a school-based or mixed (school- & leisure-based) setting, the remaining were fully leisure based (10/37%). Three quarters of the studies (20/74%) used a randomized controlled design (RCT or cRCT), the remaining used a controlled design (CT; 7/26%). Three quarters (20/74%) used a traditional waitlist-control (or school as usual), the others opted for an alternate intervention (7/26%). Most of the interventions were delivered fully digital (20/74%), the remaining quarter was partly digital with a F2F component (7/26%). Some type of sociodemographic data was collected in all studies, the most common were gender, age, socioeconomic status, nationality and ethnicity.

Participant characteristics. The mean age of the participants ranged from 10.9 to 17.9 (*M* = 14.65). The sample size ranged from 22 to 1,841 participants, giving a total of 13,857 participants at baseline and 13,216 for final analyses. For the studies that reported gender details (N = 24), 5,313 identified as females, 4,176 identified as males, and 165 did not identify with the binary gender concept. Here it has to be noted, that only three studies from the whole sample (N = 27) reported to have used gender identification options besides female and male.

Intervention characteristics. All but one study targeted multiple mental health domains. About one third (8/30%) focused on two domains, the other two thirds (18/67%) aimed at promoting mental health generally. Most commonly, interventions were delivered in multiple (17/63%) rather than single sessions (4/15%), and some (6/22%) did not specify the amount of sessions. In general, the interventions lasted between 2 to 8 weeks (14/54%). Others reported longer periods of intervention, ranging between 12-48 weeks (8/30%), did not report on their duration (1/4%) or were single session interventions (4/15%). The vast majority (24/89%) provided opportunities for participation and engagement, with more than half (15/56%) opting for a moderate level of interaction. A moderate level of interaction refers to interventions with the possibility of (peer-)feedback or automated responses, in contrast to no or considerable interaction, referring to adaptive and individually tailored responses or the possibility of professional feedback (e.g. from a psychologist). The provision of professional support was less common (20/74%), and in only 7 (26%) of the interventions a mental health professional was actively involved (e.g. responsible for intervention delivery). Three quarters (20/74%) of the interventions were fully digital. The remaining quarter (7/26%) opted for a partial digital delivery, including a F2F component.

Adherence and attrition. Less than half (13/48%) of the studies reported consistent levels of adherence, a third (9/33%) rather inconsistent levels, one reported different adherence levels with groups, and the remaining (4/15%) did not report on adherence at all. Rather inconsistent adherence was attributed to interventions where participants did not complete more than 50% of the tasks/activities or app/program usage was reported low. Drop-out rates ranged between 0 and 58.4% (M= 25.2 %), increasing across time points.

Meta-analysis

Meta- and Sensitivity Analysis. Seven clusters were created based on their outcomes: anxiety (n = 11), depressive symptoms (n = 11), externalizing symptoms (n = 6), internalizing symptoms (n = 10), protective factors (n = 11), stress (n = 7), and well-being (n = 8). Studies of the clusters depressive symptoms, externalizing symptoms, internalizing symptoms and stress did not reveal significant pooled effect sizes for interventions. However, small effects were found for studies of the clusters on anxiety (g = 0.16, 95% CI [0.02, 0.31]), well-being (g = 0.12, 95% CI [0.06, 0.15], p = 003) and protective factors (g = 0.13, 95% CI [0.05, 0.21], p = 0.006).

Subgroup Analysis. The subgroup analysis was performed with four clusters obtaining a sufficient number of studies (k > 10; anxiety, depressive symptoms, internalizing symptoms and protective factors) to investigate the influence of eight moderators on effectiveness: level of interaction, level of professional support, level of guidance, level of digitization, duration of intervention, level of adherence, level of attrition, and setting. The analysis showed moderating effects for five of the eight factors. The factors level of digitization, level of interaction and duration of intervention were non-significant. The setting showed moderating effects for anxiety and internalizing symptoms, with the highest effects for a school-based setting ($g_{anxiety}$ = 0.51, 95% CI [-0.07, 1.09], p < .001; ($g_{internalizing}$ = 0.25, 95% CI [0.13, 0.37], p < .001). A mixed setting showed also modest effects for internalizing symptoms (g = 0.20, 95% CI [-0.36, 0.76], p < .001). Leisure-based interventions showed the lowest effects in both clusters. The level of professional support was relevant for the anxiety cluster, showing that *some* level of support showed the highest effects (g = 0.59, 95% CI [-0.02, 1.20], p = .019), compared to *considerate* or *no* support. Similarly, *some* level of guidance showed the highest effects in the protective factors clusters (g = 0.66, 95% CI [-0.60, 1.93, p < .001), in comparison to considerate or no guidance. A consistent level of adherence significantly moderated the effects for the depressive symptoms clusters (g = 0.31, 95% CI [-0.23, 0.85], p < .001). Finally, low levels of attrition significantly moderated intervention effects for the anxiety cluster (g = 1.17, 95% CI [-2.96, 5.30], p = .007).

In-depth analysis of intervention content and design

As mentioned above, the literature searches resulted in 27 studies that matched our criteria and were further investigated. In a second step relevant activities, their content and design were extracted from studies that reported significant between-group (N = 15) and within-group (N = 3) effects. The reports on their efficacy and all other characteristics can be found in Table 4.

Table 4.

Outline of content and designed of reviewed interventions showing significant effects

	Study | Intervention	Activities	Content	Design
1.	#5 | De la Barrera et al., 2021 | **emoTIC** **Method:** Serious game **Theory:** Emotional intelligence model by Mayer & Salovey (1997) **Aim**: (1) Develop social-emotional intelligence and self-esteem, (2) positive effect on affect balance, emotional symptoms, behavioral problems, peer relationship problems, hyperactivity and prosocial behavior: positively impact MH and well-being **Target group**: 11-15 year olds, highschool students **Efficacy**: BETWEEN: IG showed improved self-esteem ($\eta 2$ = .12), affect balance ($\eta 2$ = .06), emotional symptoms	Game and F2F (face-to-face) sessions ● give definition ● categorize/classify concepts (e.g. stress, emotions) ● quizzes ● identification exercises (e.g. emotion) ● rating (level of arousal) ● selection exercise (e.g. most appropriate response) ● reflection ● analyze situation	Classroom sessions: 1. emotional self-examination and group sharing 2. group dynamic was carried out according to the topic, group discussion and reflection 3. summary of session by teacher Home activities: 1) acquisition of basic concepts, 2) improvement of self-knowledge, 3) testing of skills **emoTIC** The player has crashed on E-MOOD planet. Main objective = to return to Earth. <u>The activities have 4 general objectives</u>: 1. emotional perception, valuing emotions and opening to the emotional world (*What are emotions?*, *Who is feeling the emotion?*) 2. facilitation and emotional understanding (*emotions and thoughts, understanding my emotions, intelligent optimism, focusion, your own strengths, emotional network*)	Each module takes place in a different zone on the E-MOOD planet. The advance in the programme offers a positive reinforcement by obtaining the resources needed to return to Earth every time the player successfully passes an activity and moves to a new zone of the planet, as well as gaining points. ● modular program ○ Game: 4 modules with 8 activities each ○ 4 classroom sessions ○ 12 of the 32 activities are done at home (the others in class) ● intervention duration: ○ 4 weeks ○ 1 classroom session/week (group discussion/ teacher feedback in classroom sessions) ● no FU ● no mentioning of participatory design research ● web-based platform ● access from any device ● multimodal: audio, video, text ● self-paced

	Study | Intervention	Activities	Content	Design
	(η2 = .15), behavioral problems (η2 = .05) and hyperactivity (η2 = .06) **Availability**: Yes, free: https://play.google.com/store/apps/details?id=com.uvUpv.EmoTIC_Demo&hl=en&gl=US (not able to download in AUT)		3. stress management and conflict resolution 4. emotional regulation and self-motivation (*How can I manage my emotions?, traffic lights, emotional strategies*) <u>Content of activities in greater detail</u>: ● define emotions ● categorize different emotions ● quiz on emotional intelligence ● quiz on function and meaning of emotions ● identify emotions on facial expressions (multiple activities, e.g. as fast as possible [black covering stripes gradually disappear]; people speaking different languages; ● understand hidden emotions ● identify emotions related to different (emotional) situation ● respond appropriately to different emotions (expressed by aliens) ● rate their own arousal and hedonic valence level in emotions ● discover meaning of moral emotions ● analyze emotional situations ● reflect on own strengths ● coping strategies are taught and	● self-instructive ● feedback provided by main character in most activities ● virtual world ○ planet E-MOOD ○ main character = guide ○ other: aliens, robots

	Study | Intervention	Activities	Content	Design
			asked to ● indicate where stress is felt in the body ● classify different stressful situations ● 3 relaxation techniques are taught and practiced ● assertiveness is explained ● rate statements (traffic light) about emotion regulation ● think about emotion regulation strategies ● choose most appropriate emotion regulation strategy and think about their usefulness ● mimic a text conversation of a conflict between friends ● make recipe for happiness with 5 ingredients and then narrow it down to 1 ingredient ● reflect on what was learned at the end ● reflect on future and goals ● throughout: feedback and psychoeducational content is offered by the main character Activities listed in Table 2: https://drive.google.com/file/d/1syaIv_pVoHpyRt8Kewoq2NywNesk3caO/view?usp=share_link	

	Study | Intervention	Activities	Content	Design
2.	#6 | Douma et al., 2021 | **Op Koers** **Method:** Chat-based group therapy **Theory:** Beck's Cognitive Theory (Beck, 1976), ABC-model of Ellis (Ellis, 1962). Cognitive Theory of Seligman (Abramson et al., 1978) **Aim**: Positive effect on internalizing and externalizing behavioral problems, disease-related coping skills and HRQoL; Prevent and/or reduce psychosocial problems by teaching the use of engaged coping skills using CBT techniques **Target group**: 12-18 years olds, with a physical CI diagnosis **Efficacy**: BETWEEN: Beneficial effects on disease-related	Group therapy sessions ● psycho-education ○ lecture ○ videos ○ group discussions ● exercises ○ virtual board games ○ role-plays ○ skits ● homework (e.g. practicing relaxation exercise in daily life)	<u>The training consists of 3 parts:</u> 1. The main CBT principles are taught 2. More specific information on procedure and and goals are given; the theory behind technique is explained briefly 3. Practice in online subgroups; the technique is actively practices, e.g. through discussions, role-plays, and skits <u>In sum, students learn about</u>: 1. The link between situations, thoughts, feelings, and behaviors 2. cognitive biases, including pessimistic versus optimistic explanatory styles 3. cognitive restructuring skills 4. students learn a variety of techniques for coping and problem-solving, including assertiveness, negotiation, decision making, and relaxation <u>Lesson 1-8</u> Devoted to explaining and practicing the CBT derived principles: ● The link between situations, thoughts, feelings, and behaviors, ● inaccurate negative automatic thoughts (also called 'mind traps') are discussed	Life chat led by 2 psychologists ● lesson-based program ● intervention duration: ○ 5 months ○ 16 lessons á 50 minutes ● FU: 6 & 12 months ● Structured: scheduled lessons in secured chat room ○ 3-6 participants and 2 psychologists ○ each coping skill is taught during one specific lesson ○ homework after each session ● Feedback: yes, within live sessions ● no mentioning of participatory development with target group

	Study | Intervention	Activities	Content	Design
	coping skills (6-month FU: relaxation, β = 0.68; social competence, β = 0.57; info seeking, β = 0.52; 12-month FU: info seeking, β = 0.61) and health-related QoL (6-month FU: total HRQoL, β = 0.52; social-, β = 0.56; school-, β = 0.55; psychosocial-functioning, β = 0.60; 12-month FU: ns.). **Availability**: No (live session)		● formulating positive/alternative thoughts for mind traps ● searching for proof of your thoughts <u>Lesson 9-16</u> Directed at social and coping skills, self-esteem, problem solving, and decision making. ● CBT principles taught in first half are applied to the interpersonal domain ● interpersonal problem-solving <u>5 CBT-coping skills are trained</u>: ● information seeking (how?) and providing information on how to communicate the illness to peers ● use of relaxation techniques during stressful (medical) situations ● increasing knowledge of self-management and medical compliance ● improving social competence ● positive thinking [cognitive restructuring]	
3.	#8 | Egan et al., 2021 | **Singularities**	Game ● master different challenges	<u>Game specifics</u>: Role-playing game, where the player takes on the role of a *Singular* (superhuman) with	● online ● game-based program ● password-protected

	Study | Intervention	Activities	Content	Design
	Method: Serious game **Theory:** Social cognitive theory, Stress and coping theory, Social and emotional learning framework **Aim**: Improve help-seeking behaviors and productive coping strategies to reduce substance use, victimization, and mental health issues among SGMY **Target group**: 14-18 year olds, SGMI **Efficacy**: BETWEEN: IG reported lesser cyberbullying victimization, binge drinking, and marijuana use than CG. Interpret with caution: not powered for measuring efficacy (feasibility study). **Availability**: Not found: Download link was sent to participants - no website or online presence found	● identification of problems ● help other players ● find resources for help ● read virtual notebook (psycho-educative content)	special gifts who is located at school. Singulars face prejudice due to their uniqueness (driven by fear and misunderstanding of others); the player is tasked to form a team to help him/her complete the final mission: become a world-class superhero by defeating robots in the *Holochamber Challenge*. <u>Three primary components</u>: 1. it encourages help-seeking behaviors by having players create a team with other nonplayable characters and to pair a lonely nonplayable character with an appropriate mentor 2. it encourages use of productive coping strategies through active listening and helping a nonplayable character overcome anger in a healthy way 3. it raises awareness of web-based resources (SGM-inclusive) through collecting pages from a virtual notebook that contain information about external resources and bullying information <u>Player's mini objectives</u>: 1) best identify the nonplayable characters' (peers') problems 2) find the best individuals/resources to	● self-directed ● intervention duration: ns ● post-tests: 1 & 2 months ● participatory development: one-on-one, in-depth interviews with 20 SGMY about their gaming preferences were conducted; user-tested with 3 SGMY (think-aloud interviews) ● virtual world: school ○ possibility to customize your own character (torso, arms, legs, head, hair, etc..) ○ team-setting: form team and interact with nonplayable characters ● Mini-missions where they have to support their peers + feedback: ○ Positive ending for character, when they successfully helped (*Knowing she was not alone and had support helped her no longer feel afraid [...]*"; ○ Negative ending, if they didn't succeed (*Gigaton didn't learn to control his anger [...]*) ○ encouraged to replay the game, if they were not successful in helping peers - player can unlimitedly replay the game

	Study | Intervention	Activities	Content	Design
			help the nonplayable characters 3) help the nonplayable characters properly communicate or utilize their newfound resources. If the player is successful and finds the best way to help the nonplayable characters, then the nonplayable characters will join their team or help them by giving them an item or ability that will help them achieve success in the final Holochamber Challenge	
4.	#9 | Fridrici & Lohaus, 2009 | **Stress** **Method:** Website / E-learning platform **Theory:** Stress prevention **Aim**: Stress prevention **Target group**: 12-18 years old students **Efficacy**: BETWEEN: Increase in knowledge gain in all 3 IGs (OS, $\eta 2 = 0.130$; OH, $\eta 2 =$	● Quizzes ● Puzzles ● Games ● MC questions	● Basic Module: Problem-solving ● Additional program modules: ○ cognitive reconstruction ○ seeking social support ○ relaxation ○ time management <u>8 lessons with 3 steps/exercises each</u>: ● provide relevant knowledge and information referring to the lessons' main issues ● deepen content by illustrating one or more particular example(s) ● interrogate or test participants in a playful manner with regard to the contents of the lesson	● modular program ● web-based e-learning platform ● password protected ● online & F2F ● intervention duration: ○ 8 weeks (8 sessions) ○ 90 min/week ○ 2 F2F training sessions (baseline, 4 weeks) ○ no FU ● no mentioning of participatory development ● structure ○ each week one lesson was released (the earlier lessons remained available) ○ 3 exercises (steps) per lesson

	Study | Intervention	Activities	Content	Design
	0.022; F2F, $\eta 2$ = 0.060). Increase in positive thinking for OS ($\eta 2$ = 0.021) and F2F ($\eta 2$ = 0.041). Reduction of psychological stress in the F2F and OS condition (multivariate analysis was not significant). **Availability**: Not found: error for provided link (www.snake-training.de)		After completion of the 3 steps: ● 3 MC questions referring to topic	○ MC questions at the end: if they failed to provide the correct answer, participants were invited to try again (number of attempts to answer the question was not restricted; number of attempts was recorded - indicator of commitment in working with the website) ● "training guide" ○ each time when starting the program, a screen with an overview of all lessons and the associated steps was provided together with information about individual state of processing; ○ different colors and special icons indicated if lesson was released, not released, not completed ○ status display for each lesson gave detailed info about what to do next and led the user through the e-learning-curriculum ● playful and interactive arrangement of website: ○ online-games ○ link section ● Feedback: yes, if MC question was answered correctly

	Study | Intervention	Activities	Content	Design
5.	#10 | Haug et al., 2021 | **SmartCoach** **Method:** Mobile-based program **Theory:** Social Cognitive Theory (Bandura, 2004; McAlister et al., 2008) **Aim**: Promote self-management skills, social skills, and substance use resistance skills **Target group**: 14-17 year olds, secondary school students **Efficacy**: BETWEEN: IG reports lower amounts of alcohol consumed per month (*d* = -0.08), fewer cigarettes smoked per month (*d* = -0.13) and reduced perceived stress (*d* = -0.15).	Text messages ● quiz questions ● watch video clips ● post pictures ● pictures ● reply to message ● vote for other people's posts ● web links ● tasks to create individually-tailored if-then behavior plans based on implementation intentions ● message contests ● hyperlinks to audio files (e.g., audio testimonials, motivational podcasts)	● Psychoeducation through text messages with activities like: quizzes, video links, website links, reply to text message ● prize draw: program use was associated with a friendly competition (participants collected credits) <u>Messages in weeks 1-9</u>: Self-management skills, e.g., coping with stress, emotional self-regulation or management of feelings of anger and frustration <u>Messages in weeks 10-15</u>: Social skills, e.g., making requests, refusing unreasonable requests, meeting new people) <u>Messages in weeks 16-20</u>: Substance use resistance skills, e.g., recognizing and resisting media influences, social norms of substance use or the associations of self-management skills and social skills with substance use)	● mobile-based ● online ● intervention duration: ○ 22 weeks (6 months) ○ 2-4 individualized texts/week ● Stimulate active engagement: Friendly competition which will allow program users to collect credits for each interaction (e.g., answering monitoring text messages, participating in quizzes, creating messages or pictures within contests, accessing video links integrated in text messages). The more credits participants will collect, the higher their chances will be of winning one of several attractive prizes which will be part of a prize draw (10 prizes with the sum of 500 Swiss Francs) after program completion. ● Feedback: ○ peer-feedback (voting on other posts) ○ individually tailored feedback on baseline assessment for perceived stress (school, leisure time, friends, family, social

	Study | Intervention	Activities	Content	Design
	Availability: Yes, free: https://www.smartcoach.info/ (participation only for school classes)		Messages in weeks 22-24: Booster for each component in prior weeks	media) and individual coping with stress. This feedback comprises 4–5 screens, including textual and graphical feedback on stress in general, the individual level of stress in various domains compared to an age- and gender-specific refer-ence group, and individual applied and suggested coping strategies. ○ Weekly text messages were tailored according to the individual data from the baseline assessment and were based on text messaging assessment during the program runtime (e.g., on substance use or the individual's emotional state) ● developed using the MobileCoach system ● password protection & Secure Sockets (SSL) ● no mentioning of participatory development with target group
6.	#12 | Kauer et al., 2012 | **Mobiletype**	● Mood rating ● Monitoring activity ● Written response	The participants are asked to monitor their mood, stress, and daily activities on a mobile phone app / electronic diary	● mobile-based (app) ● open source software (J2ME) ● intervention duration: ○ 2-4 weeks

	Study | Intervention	Activities	Content	Design
	Method: App **Theory:** Emotional self-awareness (ESA) Stepped-care approach / <u>Methodology</u>: The experience sampling method by Larson & Csikszentmihalyi (1983) **Aim**: To decrease depressive symptoms (through increase of emotional self-awareness (ESA)); effects of ESA and the association between ESA and depressive symptoms, Well-being **Target group**: 14-24 year old patients of GPs with mild or more mental health concerns **Efficacy**: BETWEEN: Self-monitoring was shown to effectively decrease depressive symptoms in IG (κ^2 = .54), through the mediating effect of ESA (emotional self-awareness). Rumination decreased in both groups over time.		Participants were asked to assess 3 or more out of 8 areas of functioning, 4 times a day: ● <u>Current mood</u> participants indicated the extent to which they felt angry, sad, tired, stressed, anxious, happy, and alert, together with their self-perceived level of well-being, on a 6-point Likert scale in which six adjectives indicating an increasing degree of the relevant mood were displayed on the phone screen rather than numbers (with the six adjectives then being assigned rating of 0–5). ● <u>Current activity</u> 4 closed-ended questions assessed current activity, location, companionship, and enjoyment of current activity ● <u>Stress</u> In each electronic diary, the participants were asked about their experiences of stress via branched questions: *Step 1:* ‘‘Has something stressful happened since the last electronic diary’’ with yes/no response options. If no was their response, no further stress questions were asked. *Step 2*: If they responded yes to Step 1, then ‘‘How stressful	○ 4 monitoring prompts/day at random times (morning: 8-11am, noon: 11-3pm, afternoon: 3-8pm, evening: 8-10pm) ○ answer took about 1-3 min/day ○ FU: 6 weeks ● Guided with random prompts throughout the day where they had to respond with: ○ ratings (6 point Likert scale) ○ yes/no response ○ selection (bad, not bad) ○ written text function ● Feedback: individualized summary report at the end, but not during the intervention ● study manual that described the research procedure, offered troubleshooting tips and included contact information for the study coordinator, was provided to all participants. ● participatory development: ○ 3 focus groups: 1 with 3 Year 9 students and 2 with Year 11 students - *what is missing? what do you like/dislike? etc*.. ○ 1 study trial: 1-week period, feedback questionnaire - to

	Study | Intervention	Activities	Content	Design
	Availability: Not found (for use with GPs)		was it?'' was asked and response options were: Not at all, kind of bad, pretty bad, or very bad. *Step 3*: If the response was pretty bad or very bad, then the following two open-ended questions were asked: ''What happened?'', and ''Why do you think it happened?'' The closed-ended question ''how much do you feel you can control it?'' was subsequently asked, with the response options being not at all, kind of, somewhat, and definitely, followed by the open-ended question: ''What, if anything, did you do about it?'' which was again answered using the written text functional on the phones. ● <u>Alcohol use</u> ● <u>Cannabis use</u> The previous evening's alcohol and cannabis use was captured in the morning diary. A series of branched closed-ended questions assessed what type of alcohol was consumed (i.e., beer, wine, spirits, wine cooler or alcoholic cider/lemonade), the container the alcohol was served in (i.e., 30 ml shot, 285 ml ''middy'' of beer) and number of containers, main companions in drinking, and the	indicate what time of day, and day of the week, was the easiest and most difficult time to complete a diary. Young people were asked if there were times when they did not answer truthfully, what they liked most and least about the diaries, and to what extent did they feel that the diaries captured their day-to-day situations, thoughts, and feelings.

	Study | Intervention	Activities	Content	Design
			main reason for drinking ● Diet ● Sleep ● Exercise	
7.	#14 | Kutok et al, 2021 | **IMPACT** **Method:** App **Theory:** CBT, Motivational interviewing (MI) **Aim**: Prevention/Reduction of the effect of cyberbullying; to increase bystander intervention and decrease cybervictimization and postvictimization consequences, specifically social support, psychological stress and well-being **Target group**: 13-17 years **Efficacy**: BETWEEN: IG had better overall well-being (post-test, β = 1.17; FU, β = 3.24), higher bystander	● Mood rating ● Answer questions + Advice	(1) Brief remote PowerPoint intervention: ● guided by a guided by a RA using MI and CBT techniques ● 3 primary strategies: learn how to handle CV; keep it from happening; help stop it when you see it (2) App: ● daily query where participants had to give a rating (1= really bad to 5= great), e.g. *How are you feeling in general?* ● automated, tailored intervention messages (to reset norms, change actions, and improve self-efficacy and coping skills) ● additional on-demand mood messages content (including web pages and videos) ● Help Now tab on the app (if they needed immediate assistance)	● video (conferencing) sessions & mobile-based program (app) ● online ● intervention duration: ○ 8 weeks ○ 1 query + message/day ○ FU: 16 weeks ● Feedback: questions and discussion within PPT session; automated response message to daily query ● participatory development: iterative development design process; interviews with teens to elucidate both the applications of theory and the ideal structure for their intervention; all interviews were audio-recorded, transcribed verbatim and checked for accuracy prior to coding; ○ open ended questions: their cell phone and social media use broadly, their experience with online “drama” and cyberbullying, their usual strategies for coping with

	Study | Intervention	Activities	Content	Design
	self-efficacy (post-test, β = 2.65), decreased stress (post-test, β = -.66; FU, β = -.89), and higher perceived social support (FU, β = 3.50) than CG. **Availability**: Not found			cyberbullying and online drama (or their peers' strategies). Participants ○ mockups of intervention content: including storyboards of the in-clinic intervention, a sample of representative text messages, and preference testing in an A vs. B format. ○ takeaways: ■ Storyboarding makes abstract concepts approachable ■ Use of language: avoiding slang and abbreviations, preferring simple and commonly-used words; otherwise it sounds like trying to hard; or outdated; ■ Tone and theory: in the messages they used teens' exact language from interviews/ feedback; if not exact language, they portrayed it as coming *from* teens; also inspirational quotes from other teens were included - higher acceptance and normative relevance

	Study | Intervention	Activities	Content	Design
8.	#16 | Manicavasagar et al., 2014 | **Bite Back** **Method:** Website **Theory:** Positive Psychology **Aim**: To improve the overall well-being and happiness of youth **Target group**: 12-18 years **Efficacy**: WITHIN: IG reported lower depressive symptoms and stress, and higher well-being scores. The most reduction was observed in depressive symptoms and stress scores for participants with high adherence. Interpret with caution: small groups - IG split into low/high adherence. **Availability**: Yes, free: https://www.biteback.org.au/	Website ● self-help/ interactive activities ● quizzes ● blogs ● online forums ● stories ● text ● videos ● quote of the week	Website for skill development in 9 PP domains: gratitude, optimism, flow, meaning, hope, mindfulness, character strengths, healthy lifestyle, positive relationships. ● Psychoeducation on PP domains ● interactive exercises ● information about benefits ● methods for skill development ● links to other relevant resources ● building of community networks - comments and online discussion possible <u>Bite Back interactive tools</u>: ● *Snap Tha*t [mindfulness] scavenger hunt concept; participants are asked to pay attention to their surroundings, take photos of items that match specific theme; sharing with community is optional (collage) to receive feedback ● *Thank Tank* [gratitude] a gratitude journal; 3 things for each week in communal Thank Tank; sharing with community is optional ● *Bookshelf* [all domains] collection of factsheets, interviews, Q&As, videos, website links ● *Power Up* [mindfulness]	● website-based ● intervention duration: ○ at least 1 hour/week (recommended) ○ 6 weeks ○ no FU ● self-directed, but reminders were sent once a week per email ● Feedback: peer-feedback comments and online discussions possible ● Comments and uploads are being monitored and approved before becoming available for public viewing ● multimodal: text, pictures, videos, audios, forums ● Feedback from youth: ○ integrate social media (provide activities within social media to spread awareness and interest) ○ provide frequent updates (dynamic content) ○ target the right maturity level ○ provide rich media alternatives: there is a clear preference for video and graphical functionality, HOWEVER provide low-bandwidth alternatives, as not all young people have access to broadband (restricted plans) ○ recognize time constraints and

	Study | Intervention	Activities	Content	Design
			mindfulness audio tracks (can be downloaded); different interests and goals (relaxation, increasing performance, regulating emotions, amplifying senses (savoring); encourages to participate in 7, 14 or 21 challenges; option to share or keep private ● *In the Zone* [flow, character strength] videos, online discussions to watch or read on concept of Flow and how different people (including celebrities) experience it; ● *Mental Fitness* quick surveys to assess mental fitness, level of focus, gratitude and happiness ● *Real Stories* selection of real life stories posted by users about their positive experiences and overcoming life's challenges; others can read & comments (monitored) More details here: BITE-BACK_CHP13.pdf (commonwealthhealth.org)	distractions (make activities short, enjoyable and provide encouragement for repeated visits) ○ enable anonymity (anonymity is a big plus; to express themselves without fear of other people' s reactions) ○ community connection (receiving and reading feedback from peers is a core strength)
9.	#17 | O'Dea et al., 2020 | **WeClick**	● read vignettes	Designed to reduce depressive symptoms and anxiety symptoms by influencing	● mobile-based app ● online

	Study | Intervention	Activities	Content	Design
	Method: App **Theory:** CBT, Social Learning Theory **Aim**: Reducing depressive symptoms; secondary: reducing anxiety symptoms, psychological distress; increasing well-being, MH help-seeking intentions, social self-efficacy, social support and belongingness **Target group**: 12-16 year olds **Efficacy**: BETWEEN: Greater increase in well-being (*d* = 0.37) and help-seeking intentions (*d* = 0.36) for IG. Mental health outcomes can be improved with less than one hour of exposure with sustained effects at 12-week FU. **Availability**: Yes: https://play.google.com/store	● role play ● identify issues ● review situations ● provide help ● links to MH resources	cognitive and behavior change in relationships ● Interactive storytelling ● 4 character vignettes: Abigail, Jasper, Emily, Angus ● Each character faces different relationship difficulties, e.g. ○ family or family conflict ○ intimate relationship problems ○ relationship breakdown ○ parent separation ○ social anxiety ○ bullying ○ other adolescent issues (e.g. low self-esteem, drug use) ● Growth mindset: problem solving; think differently about their challenges Activities: ● user chooses a character and works through a series of activities (see below) that aim to develop the skills to overcome negative thinking and problem solving by observing what occurs in other relationships; ● by completing each of the stories, the user builds their own character profile that outlines who they can turn to for	● intervention duration: ○ single-session (1 hour) ○ FU: 4 & 12 weeks ● 4 components (character vignettes) ● Feedback: automated responses (not personalized) ● Self-paced with built-in weekly reminders ● Participatory development: cross-sectional survey to examine acceptability: (1) whether young people had experienced the types of relationship issues presented; (2) the extent to which young people felt their peers would relate to the proposed content; and (3) the level of acceptability of the relationship strategies offered by the app.

	Study | Intervention	Activities	Content	Design
	/apps/details?id=au.org.blackdoghealth.weclick&hl=en&gl=US (not able to download in AUT)		help; what they can do to keep on top of things, how they would seek help and what they can do to stay calm when faced with challenging situations CBT ● identify unhelpful thoughts/cognition ● link thoughts, behavior, emotions ● recognize consequences of unhelpful thoughts ● fact check: challenge unhelpful thoughts; alternative thinking; change perspective ● restructure unhelpful thoughts Help-seeking intentions ● identify (un)healthy coping methods ● identify support resources ● plan and consider help-seeking actions ● identify alternative solutions ● increase awareness of resources and support services ● link to range of accessible resources and support services Social Learning ● role play of behavioral experiments ● role play of help-seeking conversations ● review of situations and provide advice	

	Study | Intervention	Activities	Content	Design
			for others ● learning from peers' suggestions through helpful tips ● empathize and relate to others through use of common scenarios, challenges, experiences ● positive reinforcement through empathic questioning Skill development ● identify and prioritize dilemmas and challenges ● define and scope problems ● plan and prepare for difficult conversations ● identify and set goals ● initiate and uphold boundaries ● initiate self-care through relaxation and pleasant activities	
10.	#18 | O'Dea et al., 2021 | **Smooth Sailing** **Method:** Web-based mental health service **Theory:** Help-Seeking Theory (Rickwood et al., 2005)	● Psychoeducational content ● Fortnightly mood check-ins	Content focusing on general mental health, anxiety, depression and help-seeking behavior Module overviews with descriptions in parenthesis: ● What is mental health? (information on common mental health issues in youth; when to seek help)	5 modules + 1 additional module referring to 2 web-based, free, publicly available CBT programs (MoodGym, BRAVE) each of the 5 modules 10 minutes in length Intervention lasted 12 weeks in duration Program co-designed with young people

	Study | Intervention	Activities	Content	Design
	Aim: Improving help-seeking intentions for general MH problems: secondary: improving help-seeking behavior, anxiety and depressive symptoms, psychological distress, psychological barriers to help-seeking and MHL **Target group**: 11-19 years old; secondary school students **Efficacy**: BETWEEN: IG reported small improvements in help-seeking intentions (ES = 0.10) and a greater reduction in students who needed support for their mental health, but were not seeking help. **Availability**: Yes: service in schools in Australia		● Feeling on edge (information on anxiety; identification; potential causes; how and where to seek help; tips for managing anxiety) ● Waves of sadness (information on depression; differences between sadness and depression; potential causes; how and where to seek help; tips for coping with depression) ● When it's time to tell someone (information on when to seek help; how to talk to friends and parents; seeking help from general practitioner; the roles of different health professionals) ● When a mate needs a hand (ways of helping others including having a private chat; seeking help together; respecting the treatment process; importance of looking out for yourself) ● Don't fret, help is here (offers 2 evidence-based free cognitive-behavioral programs; young people can select preferred program)	and clinical psychologists, but no details found. Modules use animations, illustrations and hyperlinks to other credible mental health resources Self-paced modules can be completed in any order Fortnightly check-in survey measuring depression and anxiety symptoms in the past two weeks
11.	#19 | Osborn et al., 2020 | **Shamiri**	● Psychoeducational content	Content focusing on growth mindset, gratitude, and value affirmation.	3 modules in a single session intervention (6o minutes in length)

	Study | Intervention	Activities	Content	Design
	Method: Single session digital intervention **Theory:** Growth mindset theory **Aim**: Reducing depressive and anxiety symptoms, improving overall well-being; secondary: improve happiness and optimism **Target group**: 13-18 years olds, secondary school students **Efficacy**: BETWEEN: IG experienced larger declines in depressive symptoms than CG (*d* = 0.50), even more substantial effects in the high-symptom subsample (*d* = .83). The anxiety reduction was steeper than that for depressive symptoms (*d* = .29), but the study-skills condition was also associated with a steep reduction in	● Writing activities ● Reading activities	Growth-mindset interventions are designed to strengthen individuals' beliefs that personal characteristics can change and improve. Module overviews ● Growth mindset (the brain's ability to grow in response to various challenges; reading a growth testimonial written by peer; writing one's own growth story about overcoming a challenge faced) ● Gratitude (importance of expressing and practicing gratitude; writing three good things participants are grateful for) ● Value affirmation (importance of affirming personal values; writing about a time where they used their values to inform guide life decisions)	Iterative process design (experience and expertise of first author, collective experience of the authors in intervention design, feedback from recent high school students) ● Self-paced modules ● Reading and writing activities ● No audio or multimedia content

	Study | Intervention	Activities	Content	Design
	anxiety, preventing the difference from being significant. **Availability**: Yes, free: https://thrive-online.shamiri.institute/			
12.	#21 | Puolakanaho et al., 2019 | **Youth Compass** **Method:** Web-based and mobile based program **Theory:** Acceptance and commitment model (Hayes et al., 1999; Hayes and Chiarrochi, 2015) **Aim**: To decrease overall stress, school stress, and increase academic buoyancy; to enhance adolescents' psychological flexibility; **Target group**: 9th grade students, M= 15.27 **Efficacy**: Nonsig (ITT).	• Psychoeducational content • Mental exercises (e.g. mindfulness) • Behavioral exercises (e.g writing a response)	Content focused on mindfulness skills (week 1), broadening mindfulness skills into self-compassion (week 2-3), learning adaptation skills for personal and social like (week 4-5). Module overviews with descriptions in parenthesis: • Direction for life (recognizing activities that provide joy, wellbeing, and energy; examining obstacles; taking action and concrete steps to personally valued goals) • Me and my mind (exploring automatic thoughts and feelings; acceptance of thoughts, feeling, and memories as they are; developing self-awareness; cognitive diffusion - taking an observer's perspective to one own's thoughts and feelings)	5 week program with 5 modules Each module was divided into an introduction section and three different levels, including exercises at each level • participants had to complete at least 2 exercises per level to continue • 1 exercise was mandatory, others could be chosen from a list of 4 to 7 exercises • To progress from one module to another at least 6 exercises had to be completed • Most exercises were offered in both written and audio-recorded form • Exercises were divided into mental orientation exercises (mindfulness, self-reflection) and behavioral response exercises (i.e. doing an exercise, writing a

	Study | Intervention	Activities	Content	Design
	Significant effects (PP). Reduction in symptoms of overall stress (*d* = 0.22) and an increase in academic buoyancy (*d* = 0.27) favoring the IGs. Gains were larger among those with higher stress levels. **Availability**: Not found		● Staking myself (taking a new stance on thoughts and feelings; being mindful in the here and now; applying mindfulness skills to everyday life) ● Me and Myself (perception of oneself; taking a different perspective to one's thoughts and emotions, applying these skills to everyday life) ● Me and other people (promoting good relationships with friends and other people)	response or seeking answers) ● Program had 90 exercises, most no longer than 5-10 minutes Program consisted of short texts, pictures, videoclips, comic strips, and audio-based exercises. ● Exercises were focused on reading activities, audio-based activities, video-based activities, and reflection. The intervention was tailored to the needs of adolescents by modifying the ACT based exercises with a group of adolescents. The same group filmed videoclips after being introduced to the ACT concepts. Additionally, the intervention was tested in a few small pilots and modified according to feedback.
13.	#22 | Santor et al., 2007 | YooMagazine **Method:** Website	● Psychoeducational content ● Information sheets ● Posting questions ● Viewing answers to Q&A	Content focused on developmental, physical, and mental health. Website designed to promote health literacy, early detection of difficulties, and help-seeking.	Website content presented as: ● static (e.g. information sheets) ● interactive (e.g. posting questions) ● narrative (e.g. viewing answers to previously posed questions)

	Study | Intervention	Activities	Content	Design
	Theory: Proactive health and wellness model, Reactive health-needs model **Aim**: Promote health literacy, early detection of difficulties, and help-seeking **Target group**: 7-12 graders, high school, M= 14.51 - 14.94 **Efficacy**: BETWEEN: Small reduction in school worry. Positive correlation between frequency of web site use and actual help seeking behavior. **Availability**: Not found: error for provided link (www.yoomagazine.net)			Each month a key health issue in focus presented as a combination of static, interactive or narrative content. No mention of iterative design.
14.	#23 | Schleider et al., 2020 | **Growing Minds** **Method:** SSI **Theory:** Growth mindset theory **Aim**: Reducing depressive	● Psychoeducational content ● Quizzes (interactive, possibility of self-correction) ● Exercise: advising peers on coping with setbacks (writing activity)	Content focused on multiple type of mind-sets (personality, intelligence, self-regulation/-control). Module overview ● introduction to mind-sets ● intelligence mind-sets ● self-regulation mind-sets ● intelligence mind-sets	45 minute single session digital intervention 4 modules with 4 steps Intervention structure of each module: 1. scientific information about the brain or recent scientific studies 2. explanation on why abilities in a

	Study | Intervention	Activities	Content	Design
	symptoms, social anxiety symptoms, and conduct problems **Target group**: 10th graders, M= 15.3 **Efficacy**: BETWEEN: IG showed greater improvements in depressive symptom severity (*d* = .23) and larger reduction in their odds of reporting elevated depressive symptoms (*d* = .29). **Availability**: Yes, free: https://www.projectgrowingminds.com/intro			given mindset domain have potential for change and growth 3. "tips" from college-aged peers about applying a given mind-set type when coping with setbacks 4. writing exercise: answer questions (empty form); exercise in which students' use the newly acquired information to advise peers on coping with setbacks Intervention includes interactive quizzes to assess knowledge and provide opportunities for self-correction (in case of wrong answers) Modules include video explanations of concepts No mention of participatory design with adolescents
15.	#24 | Sousa et al., 2020 | **TeenPower** **Method:** mHealth app **Theory:** recent guidelines on obesity prevention and health	● Game-based with scenarios ● Infographics ● Videos ● Daily tips ● Discussion forums ● Chat ● Personalized messages	Content focused on nutrition, behavior and physical activity.	Game-based 6 month intervention App included educational resources (infographics, videos, daily tips), social support (discussion forums, chat, personalized messages), self-monitoring features (such as steps counter, hydration, sleep habits, physical activity), interactive

	Study | Intervention	Activities	Content	Design
	promotion (Kelishadi & Azizi-Soleiman, 2014; WHO, 2012; 2018) and HITAM model **Aim**: promote healthy behaviors in adolescence (lifestyle change); establish interactive education regarding health-promoting behaviors **Target group**: 12-16 year old students **Efficacy**: BETWEEN: Nutrition ($\eta 2$ = 0.03), positive life perspective ($\eta 2$ = 0.04) and global lifestyle ($\eta 2$ = 0.02) increased in IG compared to CG. Older adolescents tended to show a significant increase in rates of stress management. **Availability**: Yes, free: https://apkcombo.com/teenpower/pt.ipleiria.teenpowerapp/ (not able to download in AUT)	• Self-monitoring features (e.g. number of steps, eating habits)		training modules, and motivational tools (positive reinforcement, progression of health behaviors). Engagement with the app was rewarded with points and progress in a "wall of fame". The app is structured as a game that guides the user through scenarios while inciting obesity prevention behaviors The user is represented through a customizable avatar that goes through the scenarios Within each scenario the user can interact with placed objects to register data or access media content (e.g. in the kitchen scenario, by clicking the fridge users get access to nutritional information, while clicking the avatar brings up meal intake registration) Several predefined scenarios (kitchen, park, bedroom, gym, library). Thorough iterative design process. Design team included a user experience expert, designers, software engineers, health

	Study | Intervention	Activities	Content	Design
				professionals and a psychologist. Feedback on programs from adolescents, teachers, and health professionals.
16.	#25 | van Vliet & Andrews, 2009 | **Stress** **Method:** Internet-based programme (online course) **Theory:** Stress management, Coping strategies **Aim**: Develop knowledge about stress and effective coping strategies, increase use of effective coping strategies, and produce improved mental well-being and improved perceptions of competence to cope with stress **Target group**: 8th grade, high school (M= 13) **Efficacy**: WITHIN: Increase in knowledge (ES = 0.36), support-seeking coping (ES = 0.015), well-being (ES = 0.1).	Psychoeducational content Examples of stressful events Each lesson had a revision of the previous lesson in the beginning Related classroom activities were prepared to support the internet-based content	Content focused on stress, managing stress, coping strategies, styles of thinking, challenging thoughts, structured problem solving, achieving goals, progressive muscle relaxation and breathing exercises, daily planning and help-seeking. Module overview with description in parenthesis: ● Lesson 1 (defining stress, common causes of stress, the negative and positive effects of stress) ● Lesson 2 (coping; unhelpful coping strategies, e.g. avoidance of stressful situations/ places/ things; helpful coping strategies, e.g. talking about problems with trustworthy people, problem solving, challenging unhelpful thoughts, managing time effectively). ● Lesson 3 (association between thinking style and stress levels, process of challenging thoughts) ● Lesson 4 (taught the skill of structured problem solving, skills	6 lessons that took 30 minutes to complete each Each lesson included a revision of the previous lesson (pre-testing conducted in lesson 1) Related classroom learning activities were provided to reinforce the knowledge and skills taught on the computer The online course was presented as a cartoon narrative that followed the adventures of two characters Ben & Mia. Buddy (the tutor character) and his assistants were deliberately drawn as aliens to avoid gender or ethnic stereotyping. Students using the program were exposed to examples of stressful events and saw both characters try to cope with the events. Participatory design process

	Study | Intervention	Activities	Content	Design
	Decrease in avoidant coping (ES = 0.22), total difficulties (ES = 0.16), psychological distress (ES = 0.16). **Availability**: Yes, free at first, then to pay per student: https://ourfutures.education/modules-we-offer		need to analyze and achieve a goal by breaking it down into smaller, more manageable steps) ● Lesson 5 (ways of restoring and maintaining calm, progressive muscle relaxation, breathing exercises) ● Lesson 6 (benefits of daily planning, how to seek help, connection between mental well-being and lifestyle factors, spending time with friends, getting enough rest, and making time for fun activities)	implemented. A draft course was produced, illustrated and programmed. Students were asked the following: if the cartoon format was appealing to adolescents, if the content was relevant, and if they had suggestions to make the program more appealing. School staff were asked if the programme could be implemented and if there were ways of making the programme more effective and efficient. Mental health experts evaluated the content and delivery.
17.	#26 | Yuan, 2021 | **Mindfulness training** **Method:** Recordings **Theory:** Mindfulness training (MT) **Aim**: Explore influence of mindfulness training on resilience and emotional intelligence **Target group**: 12-14 years old; middle school students with low levels of resilience	Audio-based mindfulness training with homework	*No information on the content of the mindfulness interventions*	Mindfulness audio recording (15 minutes) every day for six months Each mindfulness daily recording accompanied with a daily homework No mention of participatory approach.

	Study | Intervention	Activities	Content	Design
	Efficacy: WITHIN: Mindfulness training increased students' resilience and emotional intelligence. **Availability**: Not found (recordings)			
18.	#27 | Zheng et al., 2021 | **REAP** **Method:** App **Theory:** 20-20-20 rule **Aim**: Reducing anxiety syndrome and eye strain **Target group**: 12-14 years old; 7th grade students **Efficacy**: BETWEEN: Significant reduction in anxiety (β = -0.36) and eye strain (β = -0.15) in homeschooled children. **Availability**: Not found	Digital behavior change intervention Students taking pictures and videos of themselves completing the exercises/activities	*No information on content as it was a behavioral intervention*	2 week intervention that was followed during school classes (distance learning during COVID-19 lockdown) Structure: ● online health information session delivered by teachers (20:20:20 rule for viewing screen content) ● during recess (4 times per day for 15 minutes) students encouraged to participate in exercise programs at home, eye relaxation techniques, or stretching exercises ● use of REAP app: live streaming platform to capture and stream their fulfillment of the exercises (physical, eye relaxation, and stretches) ● students took pictures and videos of themselves with the REAP app while fulfilling the exercises

	Study | Intervention	Activities	Content	Design
				No mention of a participatory approach.

In a second step, we deemed it worthy to take a closer look at two additional studies (Table 5). Both of the studies used an alternate intervention group, in contrast to a standard (waitlist) control group. In both studies improvements were shown for the intervention, as well as the control group. It can be assumed that the comparison program may have reduced the ability to detect positive effects of the intervention. Hence, we consider it worthwhile to examine the activities within the studies displayed in table 5.

Table 5

Outline of content and designed of reviewed interventions showing significant within-group effects

	Study | Intervention	Activity	Content	Design
1.	#4 | Craig Rushing et al., 2021 | **BRAVE** **Method:** Mobile-based program **Theory:** Principles of inclusion, equity, belonging and diversity **Aim**: Impact on physical, mental, and spiritual health; resilience, self-esteem, and coping and help-seeking skills **Target group**: 15-24 year olds, adolescents identifying as American Indian and Alaskan Native **Efficacy**: No significant effects. Both interventions improved measured health outcomes. **Availability**: Yes, free: https://www.healthynativeyouth.org/curricula/brave/ (not able to download in AUT)	Text messages with MH related content ○ videos ○ resources ○ reflective questions ○ Q&A response ○ Psychoeducation	BRAVE: The message series included links to role model videos that featured relatable characters experiencing and addressing violent behavior, alcohol misuse, and suicidality (through the eyes of a perpetrator, an IPV [intimate partner violence] survivor, and a peer bystander), intended to demonstrated important coping and help-seeking skills. The intervention was designed to amplify and reinforce: ● healthy social norms and ● cultural values ● teach suicide warning signs ● prepare youth to initiate difficult conversations with peers/trusted adults ● encourage youth to access MH resources (i.e., tribal clinics, chat lines) ● destigmatize MH services ● connect youth to trusted adults. STEM (alternate intervention): Messages designed to elevate and re-affirm Native voices in science, technology, engineering, math and medicine (STEM)	BRAVE ● 3 messages per week for 8 weeks ● 1 role model video per week (1-3 minutes each) - 7 in total STEM (alternate intervention): same as above

2.	#15 | Malboeuf-Hurtubise et al., 2021 | **Mandala** **Method:** Video-conferencing tool **Theory:** CBT, Social-emotional learning, Mindfulness **Aim**: compare efficacy of two drawing interventions, specifically the impact on anxiety, depression, inattention and hyperactivity symptoms **Target group**: 11-12 year olds, elementary school students **Efficacy**: No significant effects. Both drawing interventions may be beneficial with regards to inattention and hyperactivity. **Availability:** No (live sessions)	Drawing ● Mandala drawing ● Emotion-based directed drawing Group discussions ● share thoughts, ● …emotions, ● …overall reactions to drawings	<u>Mandala</u> (based on *CBT Art Activity Book* by Guest, J.) ● 5 mandala drawing sessions ● students were simply asked to draw one mandala without further instruction <u>Emotion-based directed</u> (based on *How Do You Doodle? Drawing my Feelings and Emotions* by Elise Gravel) Kids were instructed to complete varying drawing activities, all targeted towards exploring emotions and/or provide an occasion to discuss COVID-19 Content: 1. Draw how you feel Covid-19 story of a virus / comic strip 2. Recipe for a nice day Drawing viruses with funny names 3. Fear (draw what you are afraid of in a bottle and put a cork in it) Irritation (draw what aggravates you and throw it in the garbage can 4. Worry (draw what makes you anxious and where you feel it in your body) 5. What's the forecast in your heart today? 6. Draw your COVID-10 cure	● 5 weeks ● 1 session per week ● ~45 min per session ● secure, password-protected video conferencing platform ● led by 2 research assistants (undergraduate psychology students) - supervised by child clinician ● classroom's smart board ● teachers were present ● group discussions followed each activity in both groups

Design Outline

In a final step, a design and content outline is provided, based on the in-depth analysis. Results are clustered and summarized, so that conclusions and recommendations can be drawn for the development of the me_HeLi-D tool.

Structural features

Module- | Lesson-based programs

- 3 modules (SSI; Osborn et al., 2020)
- 4 modules à 8 activities; self-paced + 4 F2F classroom sessions (De La Barrera et al., 2021)
- 4 modules à 4 steps (SSI; Schleider et al., 2020)
- 5 modules à 10 minutes, self-paced + 1 module offering links to free evidence-based MH programs (O'Dea et al., 2021)
- 5 modules à 3 levels with at least 2 exercises (~ 10 min each) per level; 90 possible exercises in total (Puolakanaho et al., 2019)
- 6 lessons à 30 minutes, structured (van Vliet & Andrews, 2009)
- 8 modules à 90 minutes, structured + 2 F2F training sessions (Fridrici & Lohaus, 2009)
- 16 live lessons à 50 minutes, structured + homework (live chats; Douma et al., 2021)

Websites

- Bite Back: interactive, multimodal (text, pictures, videos, audio; Manicavasagar et al., 2014)
- YooMagazine: static (text), interactive (postings), narrative (answer to posts; Santor et al. 2007)

Single Session Interventions

- WeClick: app with 4 different case vignettes (O'Dea et al., 2020)
- Shamiri: web-based program with reading and writing activities (Osborn et al., 2020)
- Growing Minds: web-based program with 4 modules with videos and activities (Schleider et al., 2020)

Guidance

- Self-direct, linear/sequential
    - Main character is guide (Game; De La Barrera et al., 2021)
    - Instructions on what to do each day (Audio recordings; Yuan, 2021)

- Self-directed, non-linear/-sequential
    - Game (Egan et al., 2021)
    - Website
        - YooMagazine (Santor et al., 2007)
        - Bite Back (Manicavasagar et al., 2014)
    - App (SSI; O'Dea et al., 2020)

- Self-directed, but guided by prompts per text message
    - Text-based
        - BRAVE (Craig Rushing et al., 2021)
        - SmartCoach (Haug et al., 2021)
        - Youth Compass (Puolakanaho et al., 2019)
    - App
        - Mobiletype (Kauer et al., 2012)
        - IMPACT (Kutok et al., 2012)

- Structured and linear/sequential
    - Online sessions during school hours
        - O'Dea et al., 2021
        - Fridrici & Lohaus, 2009
        - van Vliet & Andrews, 2009
        - Osborn et al., 2020
        - Schleider et al., 2020
    - Online sessions during recess in homeschooling (Zheng et al., 2021)
    - Live sessions during school hours with in input and feedback
        - Chat (Douma et al., 2021)
        - Video-conferencing tool (Malboeuf-Hurtubise et al., 2021)
    - Sessions during school hours + tasks for home (Sousa et al., 2020)

Reminders | Prompts

- 1 daily query by text per day (Kutok et al., 2021)
- 1 reminder by email per week (Manicavasagar et al., 2014)
- 1 reminder per week, built-in app (O'Dea et al., 2020)
- 1 check-in every two weeks (O'Dea et al., 2021)
- 2-4 texts per week (Haug et al., 2021)
- 3 messages per week (Craig Rushing et al., 2021)
- 4 prompts by text per day (2-4 weeks; Kauer et al., 2012)

Features for psychoeducative content

- Text-based (all studies used some sort of text-based)
- Virtual notebook (Egan et al., 2021)
- Website Links to other MH resources (Haug et al, 2021; Kutok et al., 2021; O'Dea et al., 2020; O'Dea et al., 2021; Craig Rushing et al., 2021)
- Videos (Douma et al.,. 2021; Haug et al., 2021; Kutok et al., 2021; Manicavasagar et al., 2014; Schleider et al., 2020; Sousa et al., 2020; Craig Rushing et al., 2021)
- Quizzes (De La Barrera et al., 2021; Fridrici & Lohaus, 2009; Haug et al., 2021; Manicavasagar et al., 2014; Schleider et al., 2020)
- MC questions (Fridrici & Lohaus, 2009; Craig Rushing et al., 2021)
- Games/gamification elements - where the game itself is not a game

    - Virtual board games (Douma et al., 2021)
    - Puzzles (Fridrici & Lohaus, 2009)
    - Games (Fridrici & Lohaus, 2009)
- Text messages (Kutok et al., 2021; Sousa et al., 2020; Craig Rushing et al., 2021)
- Audio material (Haug et al., 2021)

Gamification features

Levels | Progress

- Progress bar(s)
    - Tracking of progress through 4 bars in lower right bottom of screen (Sousa et al., 2020)
    - Green bar on top where progress is depicted through "Your Thrive! Points - 1" (Osborn et al., 2020)
    - Progress bar (horizontal) at the top of the page that gets colored in (orange) with each question answered (Manicavasagar et al., 2014)

- Progress page
    - Wall of Fame - display of who has highest engagement with app (Sousa et al., 2020)
    - "Relationship profile" - progress is depicted by a circle that gets colored in (yellow) with each story/case vignette that has been completed (O'Dea et al., 2020)
    - Stress program | Fridrici & Lohaus, 2009
        - "Training guide" - on starting the program a screen with an overview of all lessons + steps, and progress was presented
        - Different colors and special icons indicated if lesson was released/ not released/ no completed
        - Status display for each lesson gave detailed info about what to do next and le the user through the e-learning curriculum

Points | Scoring

- Points
    - App engagement was rewarded with points and progress in wall of fame (Sousa et al., 2020)
    - Collection of "experience points" (green) and "emoticoins" (yellow; De la Barrera et al., 2021)
    - Result of quiz depicted as points achieved/max points (e.g. 14/20) with a circle around the number that gets colored in (orange) the more points were achieved
- Credits - collection of credits throughout the intervention (Haug et al., 2021)
- Tokens - collection of tokens [for prize draw in the end] (Manicavasagar et al., 2014)

Rewards | Prizes

- Prize draw
    - Friendly competition between users; they collect credits for each activity; the more credits, the higher the chances of winning a prize at the prize draw in the end (Haug et al., 2021)
    - Mindfulness activity challenge (7, 14 or 21 challenges); collection of tokens and prize draw; with the option to share it with the online community (Power Up; Manicavasagar et al., 2014)
- Small prizes at the end of each week for students who adhered to interventions and deduction of points for students who failed to listen to recordings (MT; Yuan, 2021)

Challenge

Participation in mindfulness activity challenge (7, 14 or 21 challenges) with the option to share it with the online community (Power Up; Manicavasagar et al., 2014)

Feedback

- Automated, individually tailored feedback/response
    - Automated response messages to daily query (Kutok et al., 2021)
    - Automated response messages (Haug et al. 2021)
    - Automated responses (not personalized; O'Dea et al., 2020)
    - Feedback after every mini-mission/-objective - encouraged to replay the game if not successful (Egan et al., 2021)
    - Feedback to MC questions - encouraged to try again if wrong answer (Fridrici & Lohaus, 2009)
    - Feedback to quiz questions - encouraged to try again if wrong answer (Schleider et al., 2020)
    - Main character gives feedback for (most) activities (De La Barrera et al., 2021)
    - Individually tailored feedback on baseline assessment for perceived stress + coping strategies (Haug et al., 2021)
    - Individualized summary report at the end (Kauer et al., 2012)
    - Q&A response (Craig Rushing et al., 2021)

- Life feedback
    - Live-classroom discussions (Malboef-Hurtubise et al., 2021)
    - Feedback in live video-conferencing session (Kutok et al., 2021)
    - Feedback in live chat-session (Douma et al., 2021)

Story | Theme | Narrative

- Cartoon narrative - the adventures of Ben & Mia; Buddy ("tutor character") guides through (Stress program; van Vliet & Andrews, 2009)
- Case vignettes (WeClick; O'Dea et al., 2020)
- Virtual world
    - Planet E-MOOD; fulfilling tasks/activities brings you to a different zone on the planet; goal = return to earth (emoTIC; De La Barrera et al., 2021)
    - At school; participant is superhuman (Singular); possibility to customize your own character; has to form a team and fulfill mini-missions together; defeat robots; final challenge: Holochamber Challenge (Singularities; Egan et al., 2021)
    - Different rooms and environments; user is guided through scenarios while inciting obesity prevention behaviors; possibility to customize own character/avatar; user can interact with objects (e.g. fridge - by clicking on it, media content is accessed; TeenPower; Sousa et al., 2020)

Customization

Possibility to customize your own character/avatar:

- Singularities; Egan et al., 2021;
- TeenPower; Sousa et al., 2020)

Social cooperation | Features for user interaction

- Peer-feedback
    - Peer-feedback on posts (Haug et al., 2021)
    - Peer-feedback, online discussions and comments (Manicavasagar et al., 2014)
    - Social support elements, such as discussion forums, chats, personalized messages (Sousa et al., 2020)
- Peer-advise: task to advise peers on coping with setbacks (Schleider et al., 2020)
- Sharing opportunities and establishment of online community
    - Take & post pictures to share them with online community (Snap That; Manicavasagar et al., 2014)
    - Write a gratitude entry and share it with only community (Thank Tank; Manicavasagar et al., 2014)
    - Write how you overcame a challenge (Story of resilience) and post it to share with online community (Real Stories; Manicavasagar et al., 2014)

Safety, privacy and usability features

- Monitoring
    - Comments and uploads are being monitored and approved before becoming available for public viewing (Manicavasagar et al., 2014)
    - Uploads of content (videos) needs to be approved by administrator (Zheng et al., 2020)
- Disclaimer
    - Disclaimer: "*Bite Back is not a crisis service*" at the bottom of each page (Manicavasagar et al., 2014)
    - "*The Bite Back website does not provide crisis intervention or counseling. The information that can be accessed on this website is not a substitute for professional care. If you are in need of urgent support or are worried about someone, please contact your local doctor or the agencies above*". (Manicavasagar et al., 2014)
- Anonymity
    - Postings can be made anonymously or kept private (Manicavasagar et al., 2014)
- Clear instructions
    - Instructional videos and handbook are provided for educators on how to use the website with their students (Manicavsagar et al., 2014)
- User interface
    - Change font size (Osborn et al., 2020)
    - Change theme/ contrast: dark/bright Osborn et al., 2020)
- External resources / emergency help
    - Tabs
        - "Help Now" tab on the app in case they needed immediate assistance (Kutok et al., 2021)
        - "Emergency Help" tab at the top left corner of screen; provision of lifelines and numbers to call in emergencies (Manicavsagar et al., 2014)
    - Buttons
        - "Get Help" button at the right, bottom of screen; provision of numbers to call, in case help is needed (O'Dea et al., 2020)
        - "Helplines and support resources" button at the bottom right corner of the screen (van Vliet & Andrews, 2009)

Content Outline

Mindfulness

Mindfulness beginners – One must be aware of the fact that a person who begins to learn about mindfulness, may initially show a decrease on the mindfulness scale, because a key realization is that one is not really mindful (Huppert & Johnson, 2010). Also, awareness should be brought to the fact that beginner's might be overwhelmed/surprised by the emotions, thoughts and sensations that may arise when they are practicing.

Exposure and degree of practice – 8 minutes per day for 4 weeks might not be sufficient. Also, the amount of practice significantly related to improvements on measures of mindfulness and well-being (Huppert & Johnson, 2010). Similarly, most benefit was found for those who visited the MH website more frequently (Manicavasagar et al., 2014; Note: the website Bite Back included mindfulness activities). It can be inferred that repeated exposure, or in other words the degree of practice of mindful activities/exercises, seems to be crucial when it comes to the enhancement of mindfulness (Huppert & Johnson, 2010). Thus, repetition of (similar) exercises should be taken into consideration, when designing the intervention.

Mindfulness activities

- Mindfulness audio tracks for different goals: relaxation, increasing performance, regulation of emotions, savoring/amplifying senses; (Power up; Manicavasagar et al., 2014)
- Mindfulness training (accepting the present moment with intentional attention and non judgemental awareness) through audio recordings (15 minutes) for six months (Yuan, 2021)

Mindfulness-related activities

As mentioned in the introduction, mindfulness enhances self-regulation, self-awareness, socio-cognitive skills and the sense of agency to navigate internal and external challenges in adolescents (Amada & Shane, 2019). Vice versa, activities that promote, e.g. self-awareness contribute to one's mindfulness. Hence, the following activities/content may be considered for program development.

Emotion regulation

- Think about emotion regulation strategies (De la Barrera et al., 2021)
- Choose most appropriate emotion regulation strategy and think about their usefulness (De la Barrera et al., 2021)
- Rate statements (traffic light) about emotion regulation (De la Barrera et al., 2021)
- React to text-messages with activities like quizzes, video links, website links aimed to enhance emotional self-regulation or management of anger and frustration; (Haug et al., 2021)
- React to automated, tailored messages that were sent in response to a daily query to change actions and improve self-efficacy (Kutok et al., 2021)
- Adopt a new attitude towards thoughts and feelings. Be mindful in the here and now. Apply skills to everyday life (module on changing perspective; Puolakanaho et al., 2019)
- Emotion-based directed drawing activities (Malboeuf-Hurtubise et al., 2021):
    - Draw what you are afraid of in a bottle and put a cork in it (fear)
    - Draw what aggravates you and throw it in the garbage can (anger)
    - Draw what makes you anxious and where you feel it in the body (worry)
    - What's the forecast in your heart today?

Relaxation

- Learn and practice three relaxation techniques (De la Barrera et al., 2021)
- Learn and use of relaxation techniques during stressful situations (Douma et al., 2021)

- Learn ways of restoring and maintaining calm, progressive muscle relaxation, breathing exercise (Lesson 5; Van Vliet et al., 2009)
- Relaxation (not specified; Fridrici & Lohaus, 2009)
- Initiate self-care through relaxation and pleasant activities (O'Dea et al., 2020)

Self-awareness

- Rate or monitor activities/ emotional states:
    - Rate one's level of arousal in emotions (intensity; De la Barrera et al., 2021)
    - Rate one's hedonic valence level in emotions (extent to which emotion is negative or positive; De la Barrera et al., 2021)
    - Rate current mood, current activity and stress 4 times per day (Kauer et al., 2012)
    - Answer a daily query on the phone and rate questions like "How are you feeling in general? (Kutok et al., 2021)
    - Monitor your steps, hydration, sleep habits, physical activity (Sousa et al., 2020)
- Indicate where stress is felt in the body (De la Barrera et al., 2021)
- Draw how you feel (Malboeuf-Hurtubise et al., 2021)
- Analyze emotional situations (De la Barrera et al., 2021)
- Explore automatic thoughts and feelings, accept thoughts, feelings, and memories as they are; develop self-awareness; cognitive diffusion: take on observer's perspective to one's own thoughts and feelings (module on the mind; Puolakanaho et al., 2019)
- Take a different perspective to one's thoughts and emotions; perception of oneself; apply skills to everyday life (module on myself; Puolakanaho et al., 2019)

Awareness/Attention

- Pay attention to one's surroundings; take photos of items that match specific themes; optional: share with online community; scavenger hunt concept (Snap That; Manicavasagar et al., 2014)
- Recognize activities that provide joy, well-being and energy; examine obstacles; take action and concrete steps to personally valued goals (module on life direction; Puolakanaho et al., 2019)
- Draw a mandala; no further instruction (Malboeuf-Hurtubise et al., 2021)

Gratitude

- Multiple times: keep an online gratitude journal; write 3 things each week that go into a communal thank tank, optional: sharing with online community (Thank Tank; Manicavasagar et al., 2014)
- Once: express and practice gratitude; write three good things you are grateful for (module on gratitude; SSI; Osborn et al., 2020)

Being mindful with others

- Module on promoting good relationships with friends and other people (Puolakanaho et al., 2019)

Well-Being

- Make recipe for happiness with 5 ingredients and then narrow it down to 1 ingredient (De la Barrera et al., 2021)
- Learn about benefits of daily planning, connection between mental well-being and lifestyle factors such as regular exercise, spending time with friends, getting enough rest, and making time for fun activities (Lesson 6; van Vliet & Andrews, 2009)

Mental Health Literacy

Obtain and maintain positive MH

- Select most appropriate response to stressful situation (stress management and conflict resolution; De La Barrera et al., 2021)
- Learn about coping strategies (De La Barrera et al., 2021)
- Identify un/healthy coping strategies (O'Dea et al., 2020)
- Improve self-efficacy and coping skills via text messages (Kutok et al., 2021)
- Learn about un/healthy coping strategies with stress (Haug et al., 2021; an Vliet & Andrews, 2009)
- Recognize and resist media influences (Haug et al., 2021)
- Learn a variety of techniques for coping and problem-solving, including assertiveness, negotiation, decision making, and relaxation (Douma et al., 2021)
- Use productive coping strategies through active listening and helping a nonplayable character overcome anger in a healthy way (Egan et al., 2021)
- Reconstruct / challenge negative thoughts (Fridrici & Lohaus, 2009; Douma et al., 2021; O'Dea et al., 2020; van Vliet & Andrews, 2009)
- Take a different perspective to one's thoughts and feelings (Puolakanaho et al., 2019)
- Read real life stories about people that overcame challenges (Real Stories; Manicavasagar et al., 2014)
- Tips for managing anxiety (O'Dea et al., 2021)
- Tips for coping with depression (O'Dea et al., 2021)
- Learn about the roles of different MH professionals (O'Dea et al., 2021)
- Choose and complete an evidence-based free cognitive-behavioral program (O'Dea et al., 2021)
- Learn about the brain's ability to grow in response to various challenges (Growth Mindset Theory; Schleider et al., 2020; Osborn et al., 2020)
- Write about your own growth story about overcoming a challenge faced (Osborn et al., 2020)
- Learn about benefits of physical activity and eye relaxation during recess (in homeschool; Yuan, 2021)

Understand and recognize mental disorders

- Classify / categorize / define concepts such as stress (De La Barrera et al., 2021; van Vliet & Andrews, 2009)
- Identify MH issues/problems and effects (O'Dea et al., 2020; van Vliet & Andrews, 2009; Egan et al., 2021)

- Identify causes (O'Dea et al., 2021; van Vliet & Andrews, 2009)
- Determine difference between sadness and depression (O'Dea et al., 2021)
- Learn about MH - 3 modules, (1) what is MH?, (2) Anxiety, (3) Depression (O'Dea et al., 2021)
- Read and interact with website content that promotes health literacy (Santor et al., 2007)
- Website incorporated a module called "Bookshelf" where a collection of factsheets, interviews, Q&As, videos and website links was offered (Manicavasagar et al., 2014)
- Read case vignettes and perform tasks (De La Barrera et al., 2021; Egan et al., 2021; O'Dea et al., 2020)
- Teach suicide warning signs (Craig-Rushing et al., 2021)

Decrease stigma

- Read web-based SGM-inclusive resources (virtual notebook) that contain information about external resources and bullying information (Egan et al., 2021)
- Character in the game faces prejudice due to their uniqueness (driven by fear and misunderstanding of others)
- Destigmatize MH services (Craig-Rushing et al., 2021)

Enhance Help-Seeking Efficacy

- To encourage help-seeking behavior, Egan et al. (2021) opted for a game-based approach. In the game, the players have to create a team with other (nonplayable) characters. So, they have to actively help the nonplayable character cope and find the most appropriate mentor or resources. In addition, they have to help them utilize the resources correctly (Egan et al., 2021).
- Information seeking (How?) and providing information on how to communicate the illness to peers (Douma et al., 2021)
- Help-seeking resources were presented on the website, e.g. collection of website links (Bookshelf; Manicavasagar et al., 2014)
- In an interactive storytelling format (app) the participants are asked to identify support resources, plan and consider help-seeking actions and identify alternative solutions for the fictional person (case vignette). The aim was to increase awareness of resources and support services, and provide links to a range of accessible resources and support services (O'Dea et al., 2020).
- Three modules focused on promotion of help-seeking: (1) Seeking-help (information on when to seek help, how to talk to others [friends, adults, MH professionals], and the roles of different MH professionals; (2) Seeking-help for others (ways of helping others, or seeking help together, respecting the treatment process, importance of looking out for yourself); (3) MH resources (two evidence-based free programs can be selected; O'Dea et al., 2021).
- Advise peers in how to cope with setbacks (Schleider et al., 2020)
- Encourage youth to access MH resources (e.g. clinics, chat lines) and connect them to trusted adults (Craig-Rushing et al., 2021)
- Prepare youth to initiate difficult conversations with peers and trusted adults (Craig-Rushing et al., 2021)

Participatory Approaches in Development

Interviews. Egan et al. (2021) conducted one-on-one, in-depth interviews with 20 sexual and gender minority youth. The aim was to find out about their gaming preferences. In addition, the game was user-tested via think-aloud interviews with 3 SGMY (Egan et al., 2021). Kutok et al. (2021) followed an iterative development design process using interviews with teens. They used open-ended questions, mockups of intervention content (including storyboards, a sample of representative text messages, preference testing in an A vs. B format). Feedback on application of theory, ideal structure of intervention and appropriate use of language (Kutok et al., 2021)

Focus groups. Kauer et al. (2021) conducted three focus groups with students, asking questions like "What is missing? What do you like/dislike …?" (Kauer et al., 2021)

Pilot study / trial. Kauer et al. (2021) performed a pilot trial for 1 week, where post-trial feedback questionnaires regarding appropriate timing of messages/prompts, truthful answering, what they liked and disliked, and to what extent they felt the diaries captured their day-to-day situations, thoughts and feelings (Kauer et al., 2021).

Feedback questionnaire /survey. Manicavasagar et al. (2014) had questionnaires about acceptance and relevance of their MH website Bite Back. O'Dea et al. (2020) examined acceptability with a cross-sectional survey. Questions referred to the fit of the content (if they experienced it and if they felt their peers would relate to it) and if the offered strategies were acceptable (O'Dea et al., 2020).

DISCUSSION

This report aims to support the evidence-based concept and content development of the module on resilience, help-seeking behavior and mindfulness of the me_HeLi-D program. It reports on which evidence-based MH programs with a digital component have been shown to be effective in supporting the MH of youth by drawing on the findings and conclusions of a previously conducted systematic review and meta-analysis (Wright et al., 2023), and provides an additional in-depth analysis of the design and content of the activities used in these interventions. Finally, a brief summary of recommendations of prior research on the development of digital programs is provided.

Efficacy was reported for 18 of the 27 analyzed studies of the sample. More than half of those were fully or partially school-based, used a randomized controlled trial design and were fully digital (no F2F component), serving as a valid foundation for the me_HeLi-D project. In accordance with the me_HeLI-D approach, all but one study focused on multiple mental health domains, which mirrors the multifaceted and complex nature of the MH as a construct.

Moderators. The findings of the subgroup meta-analysis by Wright et al. (2023) indicate that there are five moderators influencing intervention effectiveness relating to relieving anxiety, depressive symptoms, internalizing symptoms, and enhancing protective factors. A school-based setting was especially beneficial for symptoms of anxiety and internalizing symptoms, which is the chosen setting for me_HeLi-D. Some, rather than no or substantial, professional support and guidance were found to be most beneficial for alleviating anxiety and promoting protective factors. With regard to these findings, support and guidance are recommended to be moderate, leaving enough room for choice,

but providing structure nonetheless. In more detail, some level of professional support refers to the presence or involvement of a teacher or research assistant during the intervention. It can also refer to the fact that a mental health professional, such as a clinical psychologist, therapist, counselor, or research assistant with at least a mental health-related bachelor's degree advises/supervises, but is not directly involved or engaging with participants (Wright et al., 2023). Both criteria will be met within the me_HeLi-D. As for the level of guidance, some guidance means that the program is mostly self-directed, but instructions are given on the amount of exposure per day, e.g. every day 8 minutes. However, it does not necessarily need to be instructed when and where to do it (Wright et al., 2023). This will only be considered partly, and more considerable guidance will be used within the me_HeLi-D as the school-based setting does not allow for this much flexibility (at least not in the pilot and RC trials). More extensive guidance may contribute positively to higher adherence to the intervention. Not surprisingly, consistent levels of adherence (>50% completed) and low levels of attrition (<=20%) influenced efficacy (Wright et al., 2023). The issues of adherence and attrition will be tackled on many ends: school-based setting within school hours, attractive and user-friendly design, as well as interactive, engaging, and diversity-sensitive content.

Diversity-awareness. Only two studies (7%) explicitly reported having taken dimensions of diversity into consideration when developing the intervention. As it was found crucial to take diversity aspects into consideration when designing MH interventions (Wright et al., 2023), the framework for diversity-sensitive content (FDSC) will inform this issue adequately. However, several design and content elements of the included interventions exhibited diversity-sensitivity, e.g. possibility to customize your own avatar/character (Egan et al., 2021) or the option to change font size and color theme (Osborn et al., 2020). Diversity sensitivity already begins on sign-in, where multiple gender identification options should be provided, as in the example of Manicavasagar et al. (2014): female, male, non-binary, prefer not to say, prefer to self-describe (+ text box).

Participatory development approaches. As summarized in the result section and Table 4 and 5, six (33%) studies used participatory approaches in the development of their interventions. The target group was involved conducting interviews (Egan et al, 2021; Kutok et al., 2021), focus groups (Kauer et al., 2021), pilot trials (Kauer et al., 2021) and feedback surveys (Manicavasagar et al., 2014; O'Dea et al., 2020; O'Dea et al., 2021). Likewise, the me_HeLi-D program will also be developed with the feedback of the target group, using participatory workshops, feedback questionnaires and a pilot study.

Design

As only three (17%) interventions were accessible for free (in Austria), information about the design was often limited to the one within the publications. This underlines the importance of creating a sustainable program, which will be accessible to youth even beyond the project's duration.

Modules. A modular-/lesson-based approach was most common (8/45%), offering between 3 and 16 modules/lessons (M= 6.38). Which is aligned with prior research on MH interventions, ranging between 0 and 13 (M= 6.4) modules per intervention (Brown et al., 2016).

Duration. Most commonly, interventions were delivered in multiple (17/63%) rather than single sessions (4/15%), and lasted between 2 to 8 weeks (14/54%). This is similar to findings from Brown et

al. (2016), reporting a mean intervention duration of 7.8 weeks (SD= 2.4). These findings support our recommendation of developing a modular-based program with multiple sessions occurring over the period of 4-8 weeks. As many of the interventions were self-paced/directed there is a lack of data on how long sessions/activities lasted. From the ones where data was available (7/39%), sessions lasted between 10 to 90 minutes (M= 45.71). This fits our recommendation of sessions lasting one school hour (45 minutes).

Guidance. Games, apps and websites were most commonly self-directed and self-paced, as they were implemented in a leisure-based setting (11/55%). Modular or lesson-based programs were often provided during school hours with high levels of structure (linear) and guidance (9/45%). The recommendation is to develop a program that can be structured within the school-setting (for cRCT), but can also be followed self-directed. If a linear/sequential, adaptive or free navigation approach will be followed is dependent on student feedback and the possibilities of the moodle infrastructure.

Gamification features. The gamification features used within the included interventions were clustered according to the findings of Brown et al. (2016) and Cheng et al. (2019), who reviewed digital technologies for MH promotion among youth (see also Discussion, Recommendations of prior research). Eight features were identified: (1) Levels, progress, (2) points, scoring, (3), rewards, prizes, (4) feedback, (5), story, theme, narrative, (6) challenge, (7) customization, (8) social cooperation or features of user interaction. Cheng et al. (2019) and Brown et al. (2016) identified several other features, such as personalization, randomness, or artificial challenge, which were not found in the studied interventions.

It is recommended to include some kind of progress feedback, as levels or progress feedback were included in many review interventions and are the most commonly applied gamification feature in MH promoting technologies (Cheng et al., 2019). Some sort of point collection or scoring should be included, as they rank among the top 5 most commonly used gamification features (Cheng et al., 2019). However, points, badges or leaderboards are criticized in targeting intrinsic motivation and need to be carefully considered (Cheng et al., 2019). Prize draws and rewards are therefore not recommended. The implementation of feedback/encouragement is highly important for user engagement (Babbage et al., 2018, Bakker et al., 2016, Cheng et al., 2019) and should therefore be strongly considered within the me_HeLi-D program. Similarly, story-telling or narratives and themes should be included, as narrative or theme was among the most commonly observed gamification features reviewed by Cheng et al. (2019). Opportunities to share and/or interact with the online community should be provided within the me_HeLI-D program, as it is recommended that the tool allows for user interaction (Babbage et al., 2018), and features of social cooperation are underutilized, but are a way to promote well-being and meet the individual's need to relate to others (Cheng et al., 2019). Measures of safety and monitoring need to be considered carefully here.

Features for psychoeducative content. All reviewed interventions included various features for the delivery of psychoeducative content. A multimodal (text, video, audio, etc.) delivery of psychoeducative elements should therefore be an integral part of the me_HeLi-D intervention.

Safety, privacy and usability features. Features of safety, privacy and usability included monitoring content before upload, option to post anonymously, or the possibility to change the font and theme of the user interface. In line with prior research, privacy and the provision of a simple and intuitive interface is highly important (Babbage et al., 2018). The implementation of links to crisis support services is recommended (Bakker et al., 2016). Thus, the inclusion of a "Help NoW" tab or button

with free and accessible external resources, such as national lifelines, counseling options, crisis centers, is highly recommended. Further considerations about safety and privacy/confidentiality will be carefully considered within the me_HeLi-D ethical standard approach. Accessibility and usability standards will be applied according to the Web Content Accessibility Guidelines - WCAG 2.1 criteria (W3C, 2018) and Nielsen (1994) usability heuristics.

Content

The content on which the MH programs/intervention focused, was the promotion of external and internal MH-related resources, intertwined within the promotion of mental health literacy.

Mental health literacy and help-seeking behavior. Promotion of mental health literacy was addressed in depth within the wide range of psychoeducative activities, such as providing reliable MH resources (e.g. Haug et al., 2021; Manicavasagar et al., 2014) or strategies on how to main one's MH (De La Barrera et al., 2021; O'Dea et al., 2020). Some interventions included activities, where participants were asked to identify MH issues (e.g. Egan et al., 2021; O'Dea et al., 2020) and/or distinguish disorders from temporary emotional states (O'Dea et al., 2021). The latter seems to be very crucial to address, as an alarming phenomenon has been observed in the realms of social media, especially on the video-streaming platform TikTok. A growing trend has developed where users post videos of their self-described mental health symptomatology (Halting et al., 2023). While this could be great for mental health awareness, a lot of these videos convey misinformation and have been uploaded by self-diagnosed users, who often romanticize, glamourize or sexualize the disorder. In accordance with that, more and more young people, who extensively expose themselves to these contents, sought professional help, claiming to have similar, and often rare, mental health issues, such as dissociative identity disorder (DID) or Tourette's syndrome (Halting et al., 2023; Olvera et al., 2021). The link between social media and mental health needs to be researched further, for the me_HeLi-D project it will be crucial to include psychoeducative activities that bring awareness to the clear distinction between e.g. sadness or depression, or being tidy and having OCD (occupational compulsive disorder) or ADD (autism spectrum disorder).

As was shown in the result part, to effectively promote MHL in adolescents, it is recommended that the me_HeLi-D tool includes elements which address all four components of MHL: obtaining and maintaining a positive MH, understanding and recognizing mental disorders, enhancing help-seeking efficacy, and decreasing stigma (Kutcher et al., 2016). Activities encouraging help-seeking behavior showed great variability. They promoted formal (e.g. mental health professional) and informal help-seeking (e.g. friend). They targeted help seeking for self and others (how to help a friend), or promoted help-seeking directly (seek help for yourself/own character) or indirectly (seek help for others/other character). Information was provided on help-seeking in general - when, how and where to seek help. Most of the interventions included links and information about additional MH resources, and at least four of them included an own button/tab on the (home) screen for emergency/quick help (Kutok et al., 2021; Manicavasagar et al., 2014; O'Dea et al., 2020; van Vliet & Andrews, 2009). It is recommended to provide links and information of external MH resources, and to include activities which decrease stigma around help-seeking, as well as promote direct and indirect mental health help-seeking strategies.

Even though health information is increasingly sourced from the internet, interestingly, no activities relating to the finding, understanding, evaluation or application of online MH information/resources were reported to be used within the included studies. As knowledge, comprehension and critical evaluation regarding online MH resources is crucial to MHL, it is recommended that, within the me_HeLi-D project, activities relating these skills will be promoted.

Mindfulness. Only one (Yuan, 2021) among the studies that proved effective, used traditional mindfulness training as its sole intervention activity. The others used a plethora of mindfulness-related activities within their interventions. Those activities related to emotion regulation, relaxation, self-awareness, awareness/attention, mindfulness training (be attentive to the present moment with acceptance and non-judgemental awareness), gratitude and being mindful with others. Huppert and Johnson (2010) report three things that are also relevant and need to be taken into consideration in the me_HeLi-D project: (1) beginners of mindfulness practice may initially show a decrease on the mindfulness scale, as awareness is brought to the fact that one is not actually mindful, (2) beginners of mindfulness may experience overwhelm/frustration when practicing mindfulness, (3) the degree of practice / repetition is important when it comes to the promotion of mindfulness, where 8 minutes per day (for 4 weeks) did not seem sufficient (Huppert & Johnson, 2010).

Yuan (2021) asked middle school students to listen to 15 minutes of audio recordings every day for 6 months. They found that mindfulness training increased students' resilience and emotional intelligence, already after 2 months (T2). This strongly underlines the importance of repetition/practice. Mindfulness practice can help with bringing attention to the present moment, becoming aware of one's internal experience, as well as accepting and thus regulating it (Yuan, 2021). As mentioned in the introduction, mindfulness can be trained by doing exercises, such as focusing on mindful breathing (Maloney et al., 2016; Tan, 2016). In these exercises students are asked to continually bring their attention or awareness back to the present-moment experience (Tan, 2016) and gradually become more mindful and thus foster resilience (Kunzler et al., 2020). It is recommended that the me_HeLi-D program includes activities that aim at paying attention to the present moment and one's own internal experience (e.g. breathing exercise, short meditation), with an attitude of non-judgement, as this is crucial for being able to accept the present moment and self-regulate, even in unpleasant situations/states.

Regarding mindfulness-related activities, an activity that was included in almost a quarter (4/22%) of the interventions was some sort of a monitoring activity, e.g. rating one's level of arousal in emotions (De la Barrera et al., 2021) or one's current mood (Kauer et al., 2012). A similar monitoring/rating activity is recommended for the me_HeLi-D project to enhance self-awareness. Possible activities could include the rating of their current mood, or drawing a graph of their arousal throughout a typical day. Being aware of one's internal landscape is the foundation for appropriate emotion regulation. In addition to self-awareness, it is recommended to also include activities related to emotion regulation by providing emotion regulation strategies (De la Barrera et al., 2021) or encouraging a change in perspective towards one's own emotions (Puolakanaho et al., 2019).

Something closely related to the practice of mindfulness is the practice of gratitude. One effective exercise for practicing gratitude that was included in two studies (Manicavasagar et al., 2014; Osborn et al., 2020) is the *Three Blessings* exercise by the pioneer of Positive Psychology, Martin Seligman. Manicavasagar et al. (2014) also used this as an opportunity for participant's interaction by giving them the option to make their three good things public and sharing them in the *Thank Tank*. It is

recommended to include an activity similar to this one, to encourage students to shift their perspective from lack (the negative) to fullness (the positive).

Recommendations from prior research

In this final part, recommendations for the development, design and evaluation of digital programs will be discussed, drawing on findings of prior studies, reviews and meta-analysis. There exists ample research on what needs to be considered when developing a digital mental health promoting tool for youth. Here, findings from relevant studies are summarized.

Babbage et al. (2018) interviewed young people (N= 14) about their desired features of digital technologies and found six emerging themes, (1) the tool should provide a stress-free environment of relaxation; (2) the tool should use videos for motivation or music for mood regulation, thus should have an uplifting effect; (3) the tool should provide direct and individually-tailored information to additional resources and support; (4) privacy is highly important; (5) flexibility and choice should be considered carefully, so that one can choose among games, puzzles, videos or music of their preference; (6) the tool should provide space for user interaction. It should enable the user to engage with others, and have anonymous contact with people that can support.

Grist et al. (2017) systematically reviewed 24 publications on the efficacy and acceptability of mobile apps for mental health in children and adolescents younger than 18 years. Their findings suggest that the tool should be engaging, interactive and personable. Thus, the tool should be aesthetically attractive and provide the opportunity for personalization. Great focus should lie on making it inherently more engaging by design. Furthermore, information should be given in a concise way.

Bakker et al. (2016) conducted a thorough literature review on mental health applications which resulted in 16 clear, sound and practical recommendations for MH app creation. The 16 recommendations are as follows: (1) CBT-based; (2) address both anxiety and low mood; (3) designed for use by non-clinical populations; (4) automated tailoring to suit the users' needs based on self-report measures, data from user's self-monitoring, and the app's behavioral usage data; (5) self-monitoring activities, such as the reporting of thoughts, feelings and behavior; (6) recommend activities; (7) provide mental health information; (8) offer real-time engagement; (9) provide activities linked to specific reported mood problems; (10) encourage "analog" activities (with no technology involved); (11) use gamification to enhance intrinsic motivation for engagement; (12) log off past app use; (13) send reminders to engage; (14) provide a simple and intuitive interface and interactions; (15) provide links to crisis support services; (16) test in experimental trials to establish efficacy (Bakker et al., 2016; pp18).

Baños et al. (2017) reviewed online PPIs (positive psychology interventions; N= 9) aiming to promote resilience and well-being in the adolescent population. They put forward important recommendations to consider for the design and implementation of digital MH interventions. First, the specific features of the target user should be considered in the design. Second, appropriate content (e.g. language, instruction, images) and fitting design elements are both crucial elements in engaging young people. Third, the use of social media (e.g. Facebook) should be considered, as this has shown to enhance adherence to the intervention in past studies. Fourth, it is essential for efficacy to consider the setting in which the intervention will be delivered, which is aligned with findings from Wright et al. (2023). The Bite Back intervention showed efficacy in the leisure-based (Manicavasagar et al., 2014), but not the school-based (Burckhardt et al., 2015) setting, inferring that this type of intervention is better suited for the mixed or leisure-based context (Baños et al., 2017).

Gamification is a term to describe the use of elements of game design in a setting that is not a game (Brown et al., 2016). There is still little research on the use of gamification features in MH and well-being interventions/programs (Cheng et al., 2019), as well as critique around their application to MH, especially when it comes to the application of points or leaderboards (Cheng et al., 2019). And even though the research is still inconclusive, a strong link between gamification and the motivation to use an app or technology has been reported (Cheng et al., 2019). Thus, gamification features may well serve as means to increase engagement and adherence to the intervention (Brown et al., 2016; Cheng et al., 2019). Therefore, two reviews on the use of gamification features will be discussed in greater detail.

Brown et al. (2016) focused their review on MH interventions with gamification features and whether those features have an influence on adherence to the intervention. They reviewed 61 studies with 82 active intervention arms (47 interventions) targeting common mental disorders and well-being. Two thirds of these intervention arms (63/77%) were released in a sequential and predetermined order (mostly weekly releases), 16 (20%) could be freely navigated, and three (3%) used a mixed format of delivery. The gamification features reviewed by Brown et al. (2016) were: (1) goal setting (predefined or individual goal that has to be achieved in the intervention); (2) progress (the opportunity to monitor one' progression through the program with self or others); (3) feedback (automated feedback on progress); (4) rewards (the possibility to collect in-game good for achievements); (5) story/theme (set in an alternate/virtual reality, or use of an avatar or an illustrated story); (6) challenge; (7) badges/trophies; (8) points. The most commonly used gamification features were story/theme (33/40%), progress (10/12%), feedback (3/4%), goal setting (6/7%), and rewards (6/7%). Most commonly (58/71%) only one gamification feature was used within the intervention, followed by two (19/23%) and three (5/6%) incorporated features. The data remained inconclusive if gamification really does enhance adherence, but forest plots suggest that the use of multiple features may enhance adherence. In any case, Brown et al. (2016) recommend to clearly acknowledge the use of gamification features and their intended use as a way to address and increase user engagement and enjoyment.

Cheng et al. (2019) reported on the most and least commonly observed gamification features by reviewing 70 articles published between 2013 and 2018. In total, 50 apps and technologies were analyzed. For the use of gamification features, two main justifications were reported, namely to promote user engagement, and to enhance intervention effects. The most frequently applied features were: (1) levels or progress feedback (40/80%); (2) points or scoring (28/56%); (3) rewards or prizes (25/50%); (4); narrative or theme (24/48%); (5) personalization (21/44%), and (6) customization (21/44%). The least frequently applied features were: (1) artificial assistance (2/4%); (2) unlockable content (3/6%); (3) social cooperation (5/10%); (4) exploratory or open-world approach (5/10%); (5) artificial challenge (5/10%); (6) randomness (9/18%). Cheng et al. (2019) identified 17 MH domains that were targeted by the interventions, the most common MH domains were: anxiety (16/32%), well-being (10/20%), alcohol use disorder (6/12%), depressive disorders (6/12%), physical health together with MH (5/12%). Mindfulness was only targeted in one intervention (1/2%).

The above listed findings from prior research will be considered carefully for the me_HeLi-D project. And even though, not all of them can be adhered to, especially when it comes to recommendations specifically tailored to mobile apps, the recommendation is to learn as much from prior research as possible.

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