Patient Education and Counseling 143 (2026) 109429

Contents lists available at ScienceDirect

Patient Education and Counseling

journal homepage: www.journals.elsevier.com/patient-education-and-counseling

Effectiveness and acceptance of tailored web-based psychoeducation for adolescents with major depression

Maria W.H. Kloek [a,*], Regine Primbs [a], Sara Kaubisch [a], Lucia Iglhaut [a], Charlotte E. Piechaczek [a], Carolin Zsigo [a], Pia-Marie Keim [a], Lisa Feldmann [a,b], Gerd Schulte-Körne [a,b,1], Ellen Greimel [a,b,1]

[a] Department of Child and Adolescent Psychiatry, Psychosomatics, and Psychotherapy, Hospital of the Ludwig-Maximilians-University (LMU) Munich, Munich, Germany
[b] German Center for Mental Health (DZPG), Partner Site Munich-Augsburg, Munich, Germany

ARTICLE INFO

Keywords:
Psychoeducation
Web-based
Depression
Adolescent
Knowledge

ABSTRACT

Objectives: This study (ClinicalTrials.gov: NCT05300204) evaluated the effectiveness and acceptance of two distinctive components of web-based psychoeducation in improving knowledge among adolescents with major depression.
Methods: Adolescents (n = 85), aged 12–18 years, with a current or past diagnosis of depression, were randomly assigned to one of two components of the German psychoeducational website "ich bin alles" ("I am everything"), tailored for youth. The General Information Group received content on general information about depression, whereas the Self-Management Group received content on self-management. Knowledge outcomes included knowledge of general information and self-management, and acceptance measures. Changes in knowledge were analyzed using linear mixed-effect models at post-test and follow-up.
Results: A significant Time x Group interaction emerged for both knowledge outcomes (general information: $F(3,82) = 41.7$, $p < .001$; self-management $F(3,85) = 3.2$, $p = .031$). The General Information Group showed significantly greater scores in knowledge of general information than the Self-Management Group at post-test and follow-ups (all $p < .001$ $d = 1.79$–2.99). No significant between-group differences in knowledge of self-management remained after Bonferroni correction. Both groups rated the website positively in terms of usability, design, and content.
Conclusions: Web-based psychoeducation, particularly general information about depression, is an effective and well-accepted approach to improve specific knowledge in adolescents with major depression.
Practice implications: Open-access, evidence-based psychoeducational content tailored to adolescents offers a scalable tool to enhance depression literacy, with potential applicability in clinical practice.

1. Introduction

Adolescents with major depression are very likely to face a recurrence of depressive symptoms. Reported recurrence rates for developing a new episode of depression from adolescence through emerging adulthood are 43–46 % [1,2]. Untreated depression and early treatment drop-out increases the likelihood of a recurrent episode [3,4]. Particularly long-lasting depression is associated with a variety of negative outcomes such as poor academic functioning, substance use, suicidal behavior, and unemployment in adolescence and early adulthood [5,6]. Given the high recurrence rates and severe consequences associated with adolescent depression, interventions that promote long-term coping and understanding of the disorder are essential [7].

One such intervention is psychoeducation, which provides adolescents and their families with evidence-based information about mental disorders, including their diagnosis, treatment options and prognoses [8]. Additionally, it supports individuals in developing self-management skills that enable them to effectively cope with their condition [9]. In the context of depression, the primary aim of psychoeducation is to enhance individuals' understanding of the condition. A secondary aim is to

* Correspondence to: Department of Child and Adolescent Psychiatry, Psychosomatics, and Psychotherapy, LMU University Hospital, Munich, Nußbaumstr. 5, Munich 80336, Germany
E-mail address: Maria.Kloek@med.uni-muenchen.de (M.W.H. Kloek).
[1] Shared senior authorship.

https://doi.org/10.1016/j.pec.2025.109429
Received 7 January 2025; Received in revised form 27 October 2025; Accepted 19 November 2025
Available online 27 November 2025

improve their ability to manage depressive symptoms [8,9]. These objectives closely align with the concept of depression literacy, which is derived from the broader term mental health literacy. Jorm et al. [10] originally defined mental health literacy as "knowledge and beliefs about mental disorders, which aid their recognition, management, or prevention." Within this framework, depression literacy specifically refers to an individual's ability to recognize depressive symptoms, understand their underlying causes, the course of depression, and be aware of available treatments and resources [11].

Evidence demonstrates that psychoeducation in clinical practice improves treatment adherence in adults with depression [12]. Furthermore, educating affected individuals in recognizing signs of relapse and turning to available resources might offer an effective tool for the prevention of recurrent depressive episodes [9,13]. Findings from a systematic review [14] suggest the same benefits for adolescents: psychoeducation can encourage active participation in treatment and might have a positive impact on managing adolescents' depression. Together, these findings indicate that enhancing depression literacy through psychoeducation may support adolescents in recognizing, managing, and preventing depressive episodes.

Healthcare professionals can use a variety of methods to provide psychoeducational information, including narrative text, illustrations, audio (e.g., podcasts) or video [8]. Besides sharing information face-to-face, using web-based formats (e.g., websites, social media platforms, and apps) to present information is another possible option. Benefits of web-based formats, over communication with a healthcare professional, include instant access, low financial cost of using the internet, and the user's anonymity and privacy [15].

Due to factors involving a person's learning style, experienced stress, or processing of too much new information at once, most individuals only recall a limited amount of the provided health information at a healthcare visit [16,17]. In contrast, web-based formats allow people to go through psychoeducational information as often as they like, at their own pace, and at any place and time. Thus, combining methods of providing information through face-to-face communication and making use of a web-based formats, including audiovisual and text material, may enhance the impact and knowledge retention of the psychoeducational content [18,19].

To our knowledge, there are two scientifically evaluated web-based resources that provide psychoeducational content about depression, especially developed for young people with mental health problems and their families/carers: "SOVA" (publicly available online: https://sova.pitt.edu/) and "MoodHwb" [20]. Both websites and accompanying apps are primarily founded on psychoeducation and aim to enhance mental health literacy, promote self-help, provide social support, and increase professional help-seeking.

Radovic et al. [21] conducted a pilot randomized controlled trial in adolescents (12 − 19-year-olds) with symptoms of anxiety or depression who were not yet in treatment. The trial compared two groups, one receiving information as usual and the other receiving information as usual plus active reference by a health professional to view the website "SOVA". Study findings indicated an increase in treatment uptake for participants who were referred to additional information on the website "SOVA". However, an improvement ~~of~~ in depression literacy for the same participants was not found. This might have been due to the naturalistic setting of the study. More than half of the participants reported not having viewed the website.

The digital psychoeducational program "MoodHwb" was evaluated in a feasibility study among young people aged 13–23 who had either a current or past diagnosis of depression or were at an elevated risk [22]. The focus of the study was the acceptability of the program among its users. The effect of the program on depression literacy was part of the secondary outcomes. Taken together, the design features and the psychoeducational content of the program were recognized as helpful and user-friendly by young people and their parents/caregivers. Interview results with young people and professionals revealed that it would be relevant to integrate "MoodHwb" into existing mental health services. Moreover, participants' knowledge of depression improved significantly after using the program.

As illustrated above, web-based resources offering psychoeducational material on depression can be a valuable complement to face-to-face psychoeducation in therapeutic settings. In this context, the Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy of the Ludwig-Maximilians-University (LMU) University, in collaboration with the Prof. Otto Beisheim Foundation and media partners, developed the German evidence-based website "ich bin alles" (https://www.ich-bin-alles.de/; English "I am everything").

The website delivers evidence-based information on depression, including psychoeducational content on symptoms, causes, course and treatment options, based on the German guideline for the treatment of depressive disorder in childhood and adolescence [23]. Besides, the website also offers content on self-help strategies for managing depression. All psychoeducational content was developed using a participatory approach that integrated the ideas and perspectives of adolescents as well as the input of a professional design agency. This approach resulted in an innovative website design tailored for adolescents, with age-appropriate language and engaging formats such as illustrations, videos, and podcasts. Altogether, the website "ich bin alles" aims to enhance depression knowledge, promote self-management, reduce stigma, and increase help-seeking intentions among adolescents.

The primary aim of the current randomized study was to examine the effectiveness of two components of the website "ich bin alles" in improving knowledge among adolescents with depression. Both components are consistent with the website's structure and intend to enhance knowledge about depression; however, they differ in scope and objectives. The general information component corresponds to the primary aim of psychoeducation and focuses on understanding depression by delivering content about its symptoms, causes, course, and treatment options. In contrast, the self-management component reflects the secondary aim of psychoeducation and promoted self-management skills through strategies to cope with depressive symptoms.

Although each participant was assigned to only one component, knowledge in both content areas was assessed in all participants, allowing for a direct comparison of each component's effectiveness in promoting content-specific knowledge. Comparing two components within the same website, and thereby controlling for website-related features such as layout and navigation, was considered to offer a more informative alternative to a passive control group or an unrelated platform.

Based on previous research suggesting that digital psychoeducational interventions can enhance depression literacy in adolescents [22], we hypothesized that both components would increase knowledge over time. More specifically, participants were expected to show greater improvement in the specific type of knowledge targeted by their assigned content component: the General Information Group was expected to demonstrate a stronger increase in knowledge of general information about depression compared to the Self-Management Group, whereas the Self-Management Group was expected to show a greater increase in knowledge of self-management strategies compared to those in General Information Group.

A secondary aim was to evaluate the acceptance of each website component (i.e., perceived aesthetics, ease of use, utility, and overall evaluation including enjoyment). Given the participatory approach to develop the website "ich bin alles", it was expected that the website components and their respective psychoeducational content would be positively evaluated by the participants.

2. Methods

2.1. Recruitment and consent

Participants were recruited among adolescents who sought or had

previously sought in- or outpatient care at the Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy of the LMU University Hospital in Munich, Germany. Study staff informed potential participants and their parents/legal guardians about the background, aim and the experimental procedure of the study. Upon registration, written informed parental or legal guardians' consent and written assent were obtained from all young participants.

To be eligible for the study, participants were required to meet the following inclusion criteria (1) age of 12–18 years, (2) a current or past diagnosis of depression defined by the ICD-10 criteria: F32.0; F32.1; F32.2, F33.0, F33.1, F33.2, (3) an intelligence quotient (IQ) of $\geq$ 80, and (4) sufficient knowledge of the German language. Exclusion criteria were acute suicidality, a diagnosis of any psychotic disorder, pervasive developmental disorder, bipolar disorder, borderline personality disorder or substance dependence disorder.

2.2. Baseline assessment

The diagnosis of a current or past episode of depression was assessed using the semi-structured, well-established clinical interview "Kinder-DIPS" [24] by trained research assistants (supervised by a clinical psychologist). The "Kinder DIPS" assesses a wide range of psychiatric disorders in childhood and adolescence from ages 6–18 according to the ICD-10 [25]. The severity of current depressive symptoms was measured by the German version of the Beck Depression Inventory Second Edition [26]. The BDI-II is a 21-item self-report inventory, rated on a 4-point (ranging from 0 to 3) response scale, with higher scores indicating more severe symptoms.

Furthermore, to assess the IQ, the Cattell's Fluid Intelligence Test, Scale 2 [27], a non-verbal intelligence test designed for children and adolescents (9 – 19-year-olds), was used. Finally, participants and their parents/legal guardians were asked to supply demographic information. The parental socioeconomic status was classified as lower, middle and upper [28].

2.3. Randomization

Randomization was stratified by age (categorically 12 – 14-year-olds and 15 – 18-year-olds) and sex using computer-generated random numbers to randomly assign the adolescents to the General Information Group or Self-Management Group in a 1:1 ratio. Randomization assignments were saved in a predefined list that only the data manager of the study could access, who was not involved in testing participants. The assignments were created before pre-test and participants were not aware of the assigned experimental group.

2.4. Timeline

This study compared the two experimental groups at four time points: prior to viewing the assigned website component (pre-test), immediately after viewing the website component (post-test), and at two follow-up assessments: at two weeks (Follow-up 1; FU-1) and four weeks (Follow-up 2; FU-2) after the post-test. Primary outcomes were collected at pre-test, post-test, at FU-1, and FU-2. Assessments were considered valid if within 2–3 weeks (FU-1) and 4–5 weeks (FU-2) after post-test respectively. For participants outside these time frames, the data from the follow-up assessments were handled as missing data. Secondary outcomes were collected only at post-test.

Before the official website was launched in September 2021, 55 participants had been tested in the study. Following the launch of the website, it was therefore verified, if the remaining 31 participants had not visited the online version of the website previously. In case a participant visited the online website prior to an assessment, the data from that assessment and any follow-up measurements were handled as missing data.

2.5. Participants

2.5.1. Sample size calculation

The intended sample size was calculated conducting an a priori power analysis using G*Power software. Based on the results of one previous study [29], we conservatively estimated to find a small to moderate interaction effect (Cohen's $f = 0.175$) between groups at post-test, conservatively not considering repeated measurements. Then providing 80 % power, with $\alpha = .05$, and assuming 20 % drop-out, the target sample size was estimated at 82 (41 per experimental group).

2.5.2. Participant Flow

In total, 170 potential participants were assessed for eligibility by the research team. The participants flow throughout the study is provided in Supplementary Figure S1.

2.6. Presentation of website components

For the purposes of this study, an offline format of the "ich bin alles" website was developed, containing two distinct components: general information on depression and self-management of depression. These components were designed to deliver content in a controlled laboratory setting. The structure and visual design of both components were kept consistent with the "ich bin alles" website to preserve the intended user experience. Fig. 1 displays an indicative screenshot of the website's welcome screen.

General Information Group participants were presented with content providing general information about depression. This included materials on signs and symptoms (video and text), professional help for diagnosis and treatment (text), prevalence rates and comorbidities (text), the course of depression and degrees of severity (text and podcast), and causes (video and text).

Self-Management Group participants received content focused on the self-management of depression. This included a personal narrative of a young person describing her experience with self-management of depression (video), along with self-help strategies for managing low mood as a complement to professional treatment, and ten specific self-help suggestions, such as engaging in physical activity and setting achievable goals. These strategies were illustrated with examples drawn from her personal story (text and podcast).

There was no overlap in content between the two groups, and all content was accompanied by images and/or informative illustrations to enhance engagement and understanding as is the case on the official "ich bin alles" website. While the structure and design remained consistent, the amount of content presented differed between groups. This variation reflected differences in the number and type of content formats available in the two components of the website. Specifically, the general information component included a wider range of topics than the self-management component. As a result, the quantity of content differed between groups. An overview of the topics covered and their methods of delivery (video, text, podcast), is provided in Supplementary Figure S2.

The pre- and post-test survey and the presentation of the website's contents were conducted within a two- to three-hour time frame. Participants followed instructions to carefully attend to the text, podcast, video, and illustrations on the website. They were told that they would receive questions about all the content afterwards. To ensure consistent exposure and maintain a controlled experimental setting, the time available for each content item was fixed – ranging from two to eight minutes – based on the length of the text, or the duration of the audio-visual material. This standardization was intended to reduce variability between participants. Participants could watch or listen to the audio-visual material once and had sufficient time to read through the texts. These timeframes were based on exploratory testing with young people who provided input on the time required to adequately process the content prior to the start of the study.

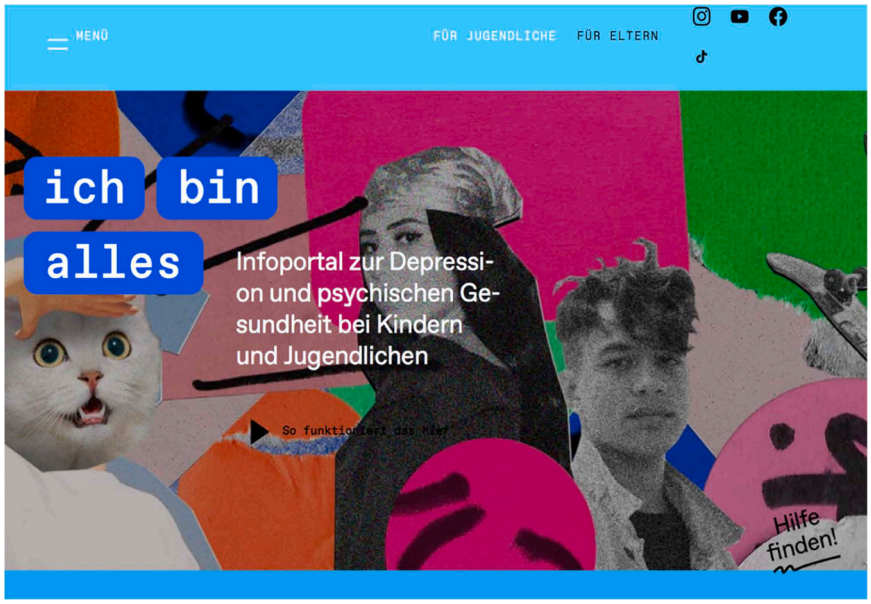

Fig. 1. Welcome screen of the "ich bin alles" Website.

2.7. Primary outcome measures

The primary outcomes were two knowledge components of depression literacy. The Adolescent Depression Knowledge Questionnaire (ADKQ) is a validated instrument [30] to assess knowledge of depression in adolescents. However, this instrument insufficiently covers the distinctive components of the website "ich bin alles". Therefore, the following two questionnaires were developed by the research group to ensure the measures were designed to capture the content being evaluated. Given that participants in the General Information Group were exposed to a broader range of psychoeducational content than those in the Self-Management Group, the questionnaire measuring knowledge of general information on depression contained more items to comprehensively reflect the content delivered.

Knowledge of general information on depression was measured using a 27-item questionnaire. The questionnaire consisted of 18 multiple-choice items (only one of the four given options was correct) and 9 dichotomous items (correct/incorrect). One point was awarded for each correct response. The total score on the questionnaire ranged from 0 to a maximum possible score of 27, with higher scores indicating greater knowledge of general information on depression.

Knowledge of self-management of depression was measured using a 12-item questionnaire. The questionnaire consisted of 11 multiple-choice items (only one of the four given options was correct) and 1 dichotomous item (correct/incorrect). One point was awarded for each correct response. The total score on the questionnaire ranged from 0 to a maximum possible score of 12, with higher scores indicating greater knowledge of self-management of depression.

2.8. Secondary outcome measures

Secondary outcomes, which included the evaluation of the website's acceptance, were: perceived visual aesthetics, ease of use (i.e., user-friendliness), utility (i.e., perceived helpfulness), and overall judgement (including perceived enjoyment) [31] of the website components and their respective psychoeducational content.

The visual aesthetics of the website components were assessed using the Visual Aesthetics of Websites Inventory Short Version (VisAWI-S) [32]. This short version of the VisAWI is a self-report inventory consisting of 4 items. Participants indicated their response (e.g., "The layout appears professionally designed") on a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). An overall evaluation value exceeding 4.5 suggests that participants perceive the website as positive.

To evaluate the ease of use, utility, and enjoyment of each website component and its psychoeducational content, we developed a 10-item self-report questionnaire. The questionnaire consisted of 2 items that assess the utility (e.g., "I think the website is well suited for young people aged 12–18 years old"), 4 items that assess the ease of use (e.g., "I have understood the content of the podcast.") and 4 items that assess the enjoyment of the website (e.g., "Viewing the website was fun"). Participants indicated their responses on a four-point Likert scale (1 = "inaccurate," 2 = "somewhat accurate," 3 = "mainly accurate," and 4 = "entirely accurate").

Furthermore, to assess participants' overall judgement of the website component, they were asked to assign a grade using a six-point grading scale (1 = "*excellent*," 2 = "*good*," 3 = "*satisfactory*," 4 = "*sufficient*," 5 = "*poor,*" and 6 = "*insufficient*"), which is also used in the German school system.

2.9. Data analysis

Raw scores of depression knowledge (general information on depression and self-management of depression) were converted into index scores. These were calculated by dividing each participant's total score by the maximum possible score on the respective questionnaire. Hence, the index score multiplied by 100 represents the percentage of correct responses. on the questionnaire. Mean imputation was carried out to handle single missing items. This concerned 0.7 % of the items on all questionnaires assessing knowledge of general information on depression and 0.1 % of the items on all questionnaires assessing knowledge of self-management of depression.

All Data analyses were conducted using SPSS Statistics, version 26. Data was analyzed according to the intent-to-treat (ITT) principle, which included all participants ($N = 85$). Demographic and diagnostic characteristics, as well as baseline depression knowledge and post-test acceptance ratings were analyzed using descriptive statistics. Differences between the two groups at baseline and in acceptance ratings were tested by independent-samples *t*-test and Chi-square tests. Unless otherwise specified, statistical significance was set at $p < .05$ for all analyses.

To identify changes in knowledge scores over time (pre-test, post-

test, FU-1 and FU-2), between the General Information Group and the Self-Management Group, we used a linear mixed model (LMM) repeated measures with a maximum likelihood estimator. The LMM assumed fixed effects of group, time, and the group-by-time interactions, and specified correlated random effects for each participant. We used an unstructured covariance type to model within-subject variation. Degrees of freedom were estimated using Satterthwaite's approximation. A LMM uses, in contrast to a repeated measures ANOVA, all available measurement points for each participant under the assumption that incomplete data are missing at random [32].

Estimated marginal means (EMMs) derived from the LMM were calculated for each group and time point. To further interpret significant effects, pairwise comparisons between groups were conducted at each time point (pre-test, post-test, FU-1, and FU-2). These post-hoc comparisons were based on mean differences in EMMs and were Bonferroni-corrected by dividing the alpha level (.05) by the number of comparisons (n = 4), resulting in a significance threshold of $p < .0125$. This approach allowed for a detailed examination of group differences in knowledge scores over time.

To quantify the magnitude of between-group differences, Cohen's *d* was calculated by dividing the mean difference between the EMMs by the square root of the residual variance. This residual variance was obtained from a simplified linear mixed model (LMM) that retained the same fixed effects but excluded the repeated covariance structure. Confidence intervals for *d* were calculated using the standard error of the mean difference and the residual variance. This approach aligns with the practical recommendations of Brysbaert and Stevens [33], who suggest using residual variance from simplified models to approximate pooled standard deviations when calculating Cohen's *d* in the context of mixed models.

2.10. Transparency and openness

The study protocol was approved by the institutional review board of the Medical Faculty at the LMU University Hospital in Munich (No. 20114) and pre-registered at ClinicalTrials.gov (NCT05300204). Data collection took place from January 2021 to May 2022. We report how we determined our sample size, all data exclusions, all manipulations, and all measures of the study. The data set for the present study is not publicly available.

3. Results

3.1. Baseline characteristics

Table 1 shows the demographic and diagnostic characteristics of the participants in both experimental groups at baseline (pre-test). A significant difference was found between participants who had previously received treatment for depression and those who were currently undergoing treatment. In the final sample, participants' ages ranged between 13 and 17 years.

3.2. Knowledge of general information on depression

As shown in Table 2, there were no significant differences between groups at pre-test ($p = .999$; $d = 0.00$, 95 % CI [-0.75, 0.75]), suggesting comparable baseline knowledge levels. A mixed model repeated measures revealed a significant Time x Group interaction $F(3, 83.2) = 41.7$, $p < .001$, indicating that changes in knowledge of general information over time differed significantly between the General Information Group and the Self-Management Group. At post-test, the General Information Group demonstrated significantly greater knowledge than the Self-Management Group ($p < .001$), with a large effect size ($d = 2.99$, 95 %CI [2.31, 3.67]). This advantage persisted at FU-1 ($p < .001$; $d = 2.06$) and FU-2 ($p < .001$; $d = 1.79$), with consistently higher knowledge scores in the General Information Group. All between-group differences from post-test onward remained statistically significant after Bonferroni correction (adjusted $\alpha = .0125$). Fig. 2a presents a plot of the change in knowledge of general information on depression scores, expressed as the average percentage of correct responses by group over time.

Table 1
Demographic and diagnostic characteristics of participants by group at pre-test.

Characteristic	Total ($N = 85$)	General Information ($n = 43$)	Self-Management ($n = 42$)	Test Statistic (*p*-value)
Age (years), mean (SD)	15.6 (1.6)	15.8 (1.5)	15.7 (1.6)	$t = .36$ ($p = .72$)
Sex, n (%)				
Female	68 (80)	36 (84)	32 (76)	
Male	17 (20)	7 (16)	10 (24)	$\chi^2 = .75$ ($p = .39$)
IQ, mean (SD)	111.1 (12.4)	110.1 (11.7)	112.4 (13.1)	$t = .84$ ($p = .40$)
Parents' socioeconomic status, n (%)				
Lower	0 (0)	0 (0)	0 (0)	
Middle	23 (30)	11 (30)	12 (31)	
Upper	53 (70)	26 (70)	27 (69)	$\chi^2 = .01$ ($p = .92$)
Depression, n (%)				
Current	42 (51)	24 (56)	18 (43)	
Past	43 (49)	19 (44)	24 (57)	$\chi^2 = 1.43$ ($p = .23$)
BDI-II, mean (SD)	24.2 (13.4)	23.1 (10.8)	25.4 (15.7)	$t = .80$ ($p = .43$)
Treatment for depression, n (%)				
Current	75 (89)	42 (98)	33 (80)	
Past	9 (11)	1 (2)	8 (20)	$\chi^2 = 6.48$ ($p = .01$)

Note. General Information = group with general information on depression; Self-Management = group with information on self-management of depression. Parents' socioeconomic status: $n = 76$; treatment for depression: $n = 84$.

Table 2
Estimated marginal means and between-group comparisons for knowledge of general information on depression across four time points.

Time	General Information (EMM ± SD)	Self-Management (EMM ± SD)	Mean difference	*p*-value	Cohen's *d* [95 % CI]
Pre-test	0.64 ± 0.02	0.64 ± 0.02	0.00	.999	0.00 [–0.75, 0.75]
Post-test	0.82 ± 0.01	0.66 ± 0.01	0.16	< .001	2.99 [2.31, 3.67]
Follow-up 1	0.80 ± 0.01	0.69 ± 0.01	0.11	< .001	2.06 [1.45, 2.67]
Follow-up 2	0.80 ± 0.01	0.70 ± 0.01	0.10	< .001	1.79 [1.15, 2.43]

Note. General Information = group with general information on depression; Self-Management = group with information on self-management of depression; EMM = estimated marginal mean; SD = standard deviation; CI = confidence interval. The alpha level was Bonferroni-corrected (α =.0125). Cohen's *d* reflects the standardized mean differences; positive values indicate higher scores in the General Information group.

3.3. Knowledge of self-management of depression

As shown in Table 3, no significant between-group differences were observed at pre-test ($p = .836$, $d = 0.09$, 95 % CI [-0.79, 0.97]),

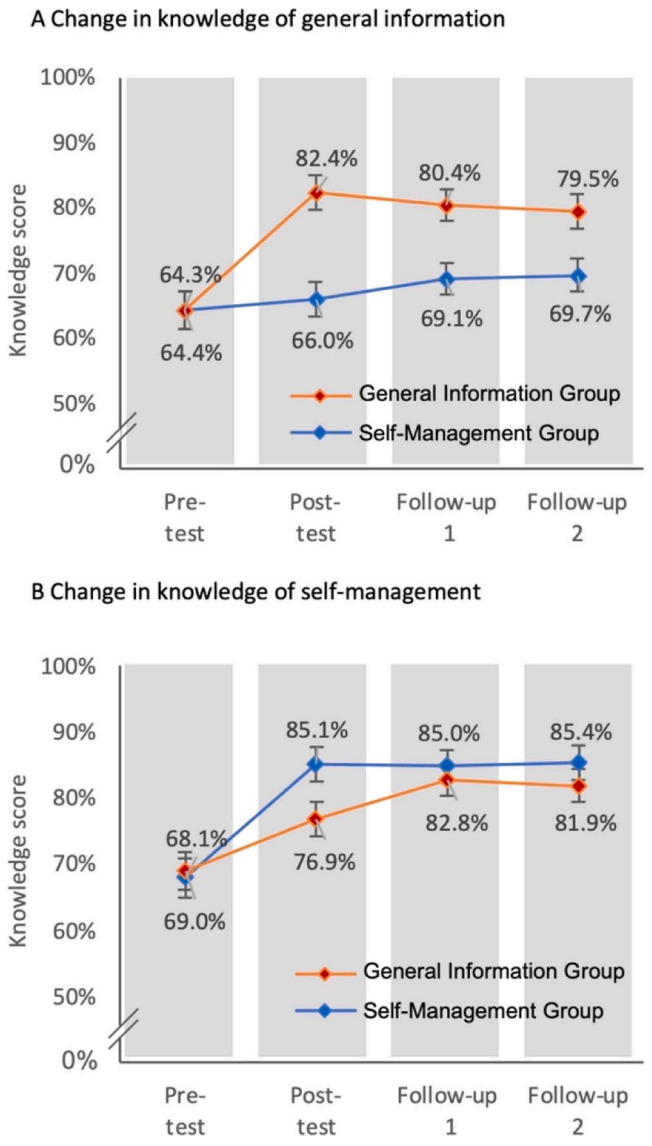

Fig. 2. Change in knowledge expressed as the average percentage of correct responses by group over time.

suggesting comparable baseline knowledge levels. A mixed model repeated measures analysis revealed a significant Time x Group interaction, $F(3, 84.5) = 3.2$, $p = .031$, indicating that changes in knowledge of self-management over time differed significantly between the General Information Group and the Self-Management Group. Although the significant interaction suggests differing patterns of change between groups, post-hoc comparisons did not identify any statistically significant between-group differences at individual time points. At post-test, the Self-Management Group showed higher knowledge scores than the General Information Group ($p = .024$; $d = 0.82$, 95 % CI [-0.11, 1.53]); however, this difference did not remain statistically significant after Bonferroni correction (adjusted $\alpha = .0125$). No significant differences were observed at FU-1 ($p = .458$) or FU-2 ($p = .319$). Fig. 2b presents a plot of the change in knowledge of general information on depression scores, expressed as the average percentage of correct responses by group over time.

3.4. Sensitivity analysis

Due to the imbalance between the two experimental group regarding the participants' status of treatment (current or past), we undertook a sensitivity analysis to examine how the primary outcomes were affected by the inclusion of participants with a past treatment for depression. When participants with a past treatment for depression were removed, the Time x Group interaction for the change in knowledge of general information was still significant $F(3, 73.9) = 33.6$, $p < .001$. Similarly, the Time x Group interaction for the change in knowledge of self-management still proved to be significant $F(3, 74.9) = 2.8$, $p = .048$.

Table 3
Estimated marginal means and between-group comparisons for knowledge of self-management of depression across four time points.

Time	General Information (EMM ± SD)	Self-Management (EMM ± SD)	Mean difference	*p*-value	Cohen's *d* [95 % CI]
Pre-test	0.69 ± 0.03	0.68 ± 0.03	0.01	.836	-0.09 [–0.79, 0.97]
Post-test	0.77 ± 0.03	0.85 ± 0.03	0.08	.024	0.82 [0.11, 1.53]
Follow-up 1	0.83 ± 0.02	0.85 ± 0.02	0.02	.458	0.22 [–0.37, 0.81]
Follow-up 2	0.82 ± 0.02	0.85 ± 0.03	0.03	.319	0.34 [–0.33, 1.01]

Note. General Information = group with general information on depression; Self-Management = group with information on self-management of depression; EMM = estimated marginal mean; SD = standard deviation; CI = confidence interval. The alpha level was Bonferroni-corrected (α =.0125). Cohen's *d* reflects the standardized mean differences; positive values indicate higher scores in the Self-Management group.

3.5. Acceptance

3.5.1. Visual aesthetics

Participants in the General Information Group evaluated the website's design with a mean VisAWI-S score of $M = 5.74$ ($SD = 0.99$). In the Self-Management Group, a mean VisAWI-S score of $M = 5.43$ ($SD = 1.13$) was measured. Thus, participants of this study evaluated the design of the website components as positive (mean VisAWI-S score $M > 4.5$). There was no significant difference between the two groups ($t(83) = -1.34$, $p = .182$).

3.5.2. Perceived ease of use, utility and enjoyment

The questionnaire findings on the perceived utility ease of use and enjoyment of the website components and their psychoeducational content, as reported by the participants in the General Information Group and Self-Management Group, are presented in Figs. 3 and 4. Overall, it is evident that participants perceived the structure of the website components as user-friendly, would recommend the components of the website to their peers, and enjoyed viewing the psychoeducational content (texts, podcasts, and videos).

3.5.3. Perceived overall judgement

Based on the German school grading, system, the website was rated with a mean score of $M = 1.81$ ($SD = 0.63$) by participant in the General Information Group and $M = 1.85$ ($SD = 0.66$) by participants in the Self-Management Group, corresponding to ratings between "excellent" and "good". There was no significant difference between the two groups ($t(81) = 0.25$, $p = .801$).

4. Discussion and conclusion

4.1. Discussion

This study examined the effects of two distinct psychoeducational

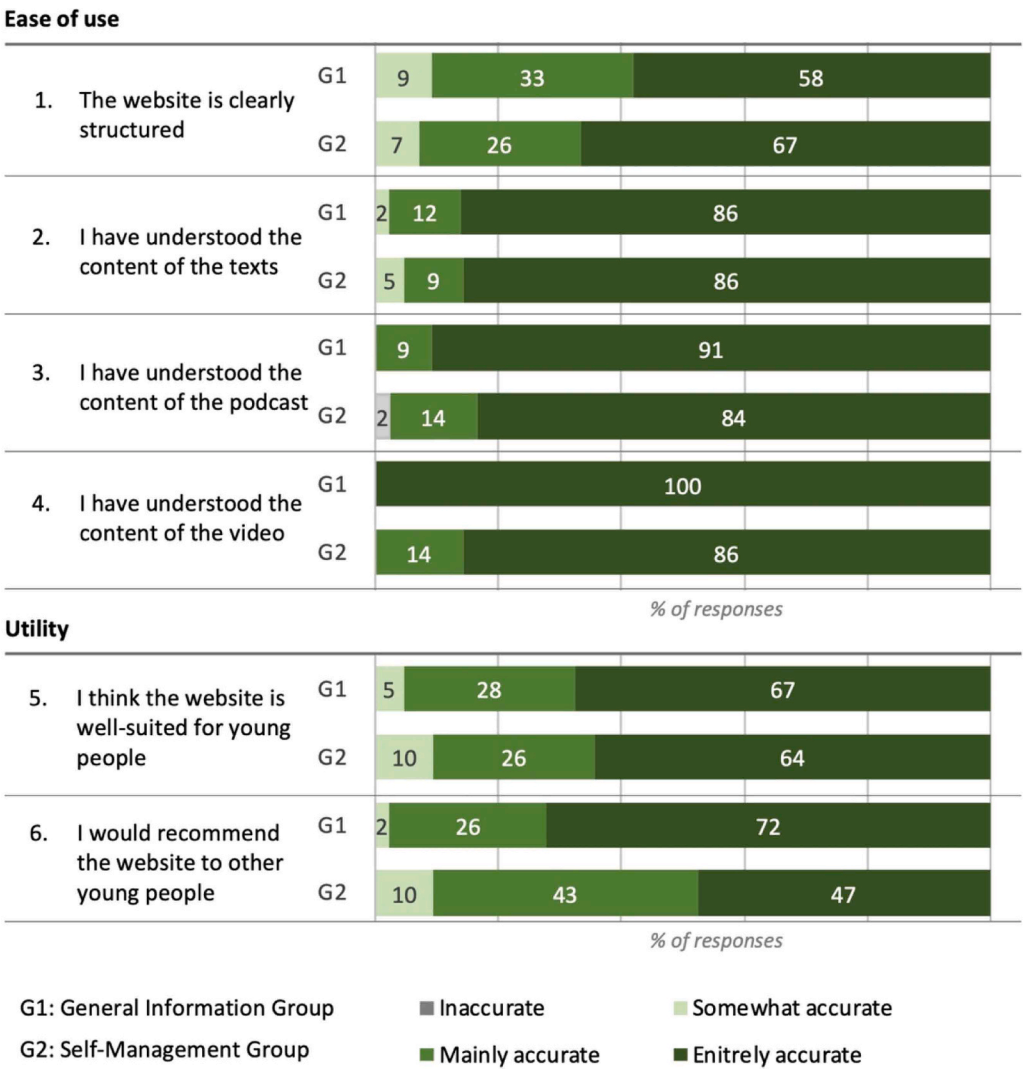

Fig. 3. Perceived ease of use and utility of the website components and their psychoeducational content.

content components (general Information and self-management) of the website "ich bin alles" on two corresponding knowledge outcomes among adolescents with depression. The main results showed that the general information component of the website "ich bin alles" led to an improvement in knowledge of general information on depression that was maintained over time, whereas the self-management component had no robust impact. Moreover, the website's design and psychoeducational content were positively evaluated by the young participants.

As predicted, participants assigned to the General Information Group demonstrated a greater increase in knowledge of general information about depression compared to the Self-Management Group. Group differences were evident at post-test and remained stable across both follow-up assessments (FU-1 and FU-2). The sustained between-group differences of large effect size suggest that delivering general information about depression in a web-based format may be particularly effective in enhancing adolescents' understanding of depression. This finding underscores the potential value of incorporating general information components into psychoeducational web-based resources aimed at improving depression literacy among adolescents.

The self-management component showed only a limited impact on knowledge acquisition. Although the trajectory of knowledge change differed between groups, a significant group difference was observed only at post-test and did not withstand correction for multiple comparisons. Interestingly, knowledge of self-management appeared to develop similarly in both groups over time, as no significant differences between groups were observed at the follow-up assessments. This unexpected pattern may be explained by problem-solving theory [34], which suggests that acquiring general information, such as recognizing stress as a contributing factor to depression, can lead individuals to infer relevant coping strategies for everyday life [35]. This type of indirect learning could explain why the groups' knowledge of self-management converged over time.

Our main results on knowledge of depression are generally in line with previous randomized controlled studies, which have found that providing psychoeducational information is effective for increasing depression literacy among adolescents [29,36]. The major difference from our study was the use of different methods of providing information: a booklet including narrative text and illustrations [36] and a 3-hour school-based curriculum including interactive lectures and videos [29]. Additionally, Ruble et al. [29] included participants from a general adolescent population without any mental health problems, whereas our sample consisted of adolescents with a past or current diagnosis of depression. By examining the effects of tailored psychoeducation content in a web-based format within a clinical sample of adolescents, our study highlights the potential of web-based interventions to support mental health literacy in a young vulnerable population.

Our findings on acceptance reveal that the website components were positively received by adolescents. The result that young participants

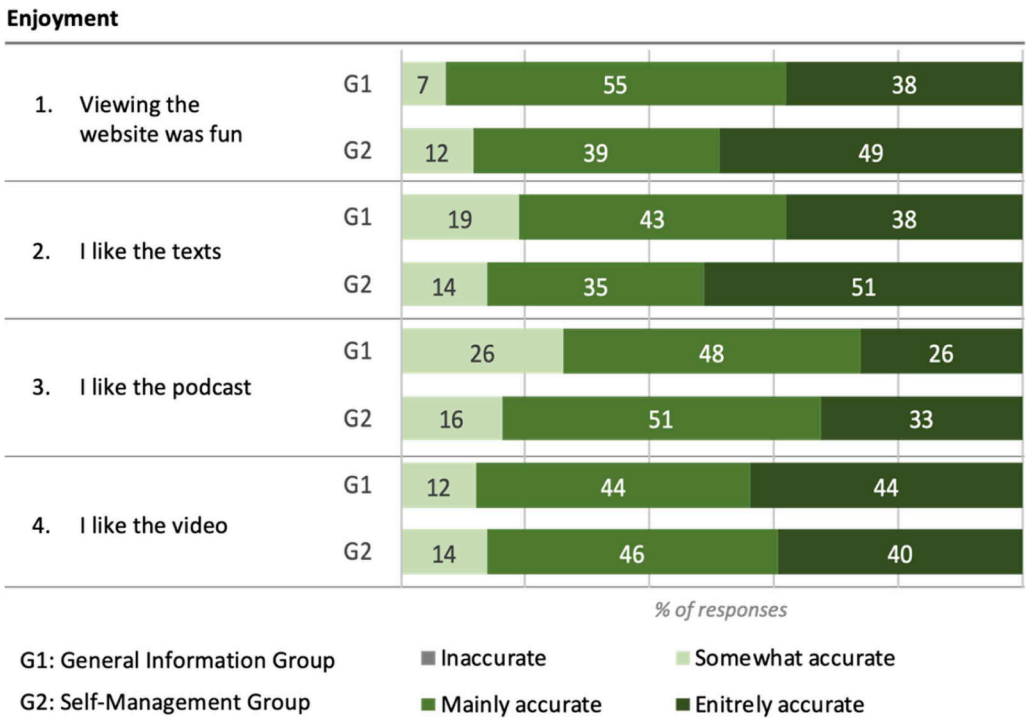

Fig. 4. Perceived enjoyment of the website components and their psychoeducational content.

were positive about the visual aesthetics of the website components is crucial, considering that the initial positive impression of a website's aesthetics can have a positive impact on the user's attitude (e.g., perceived utility or enjoyment) toward its content [37,38]. Such appeal is essential to ensure that young visitors review the psychoeducational information and regularly return to the website.

Moreover, participants' tendency to recommend the web-based psychoeducation to peers indicates that the psychoeducational content is perceived as helpful among adolescents with depression or a history of depression. In this context, it is notable that a higher proportion rated the statement "I would recommend the website to other young people" as "entirely accurate" in the General Information Group compared to the Self-Management Group. We hypothesize that this difference reflects the broader relevance of the general information content, which may be perceived as suitable for a wide range of adolescents, including those without direct experience of depression. In contrast, the self-management content is more specific to adolescents currently experiencing depressive symptoms, which may have somewhat limited participants' willingness to recommend it to peers in general.

The findings have several implications for the future development of the website "ich bin alles". First, the robust and sustained effect of the general information component highlights the importance of maintaining and further strengthening this content. Second, the limited effects of the self-management component suggest that revisions would be beneficial to enhance its impact. One promising approach would be to add more interactive and practice-oriented material to this component, such as guided reflections or scenario-based tasks that actively engage users in applying comping skills to their own experiences. Finally, although participants evaluated the website positively overall, the results indicate that there is some room for improvement in enjoyment. Increasing the interactivity and personalization of the self-management content could therefore not only strengthen knowledge outcomes but also enhance users' enjoyment.

This study has several notable strengths. Firstly, recruiting a clinical sample provides crucial insights into depression literacy in adolescents with a current or past diagnosis of major depression. The follow-up measurements (FU-1 and FU-2) allowed us to measure the retention of the initial acquired knowledge. This is particularly relevant in a clinical population, as depression or remitted depression is frequently associated with cognitive deficits, including impairments in long-term memory [39], which may negatively affect the retention of acquired knowledge. However, it should be noted that follow-up measurements in this study were relatively short-term. In future research on the website, it would be important to examine the longer-term maintenance of the knowledge of depression.

Secondly, the distinctive psychoeducational content of the website "ich bin alles" was shown to be effective and positively received among adolescents. The official website "ich bin alles" offers open access to scientifically evaluated psychoeducational content at no cost. Our study may therefore serve as an impetus for further development of similar publicly available web-based resources and their scientific evaluation.

The unequal amount of psychoeducational content presented in the General Information Group versus the Self-Management Group could be considered a limitation of this study. Consequently, the test procedure for the General Information Group took longer than for the Self-Management Group, which might have increased the risk of performance bias and might have affected the outcome measurements. However, the distinctive components (general information and self-management) are consistent with the primary and secondary aims of psychoeducation [8], and in line with the natural structure of the components of the official website "ich bin alles". For this reason, we chose to evaluate the components as they were designed, including the imbalance in content. This allowed for a direct comparison of their effectiveness and enabled conclusions to be drawn about the specific contributions of psychoeducation in relation to its primary and secondary aims.

Furthermore, there was an overrepresentation of participants with higher education and above-average IQ in the study sample. Females also formed the vast majority in the study sample. Accordingly, future studies with a more representative population, e.g., with more male participants and a more diverse range of parental socioeconomic statuses, are needed to increase the generalizability of the findings. Another limitation to consider is the use of self-developed outcomes measures for primary and some of the secondary outcomes, for which reliability and

validity have not been evaluated. While this should be clearly acknowledged as methodological limitation, the use of customized instruments was necessary given the specific psychoeducational content of the website.

The website "ich bin alles" was developed using a participatory approach that incorporated adolescents' perspectives, resulting in a highly tailored and engaging web-based resource for this age group. Additionally, the development process involved collaboration with a professional design agency, which contributed to the website's appealing, target-group specific design and user-friendly navigation. Due to these unique features, comparing two components within the same website was a deliberate methodological decision, and provided a more informative alternative to using a passive control group or an unrelated web-based resource with differing design characteristics.

To draw comprehensive conclusions about the effectiveness of the full website "ich bin alles" in future studies, different types of comparisons should be considered depending on the research question. For example, if the aim is to evaluate the effectiveness of specific psychoeducational content, comparisons should focus on different content presented in the same web-based format. In contrast, if the focus is on the mode of delivery, the same content could be tested in an alternative format, such as face-to-face psychoeducation.

The current study design provides evidence of the knowledge component of depression literacy. However, this study does not provide evidence of the extent to which the acquired knowledge results in, for example, changes of help-seeking behavior or self-stigmatizing attitudes among adolescents. Help-seeking behavior and stigma surrounding mental health problems can also be considered components of mental health literacy [40]. Improvements in such outcomes might have a positive impact on adolescents' treatment adherence and coping with their depression or low mood. Including respective outcome measures in future studies could lead to further insights on into how to enhance psychoeducational content on web-based resources or other formats for this target group.

4.2. Conclusion

This study demonstrated that psychoeducational contents, specifically, general information on depression, delivered in a web-based format was successful in improving understanding of depression in a clinical adolescent sample. Moreover, a publicly available website with youth-appropriate language in text, videos, and podcasts is an accessible and attractive tool for adolescents to strengthen their knowledge of depression.

4.3. Practice implications

Depression in adolescents is a major public health concern. Psychoeducation plays a key role in improving adolescents' understanding of depression and supporting self-management. Delivering psychoeducational content is therefore an important aspect of clinicians' work. Based on our findings, web-based psychoeducation such as the website "ich bin alles", can serve as an adjunct tool for delivering psychoeducation in clinical practice.

Clinicians may, for example, integrate specific psychoeducational content, such as a video explaining the signs and symptoms of depression, into therapeutic sessions to convey core information and enhance adolescents' understanding of the condition. Between sessions, adolescents can be encouraged to engage with web-based content independently and to select one self-management strategy to apply in daily life. The selected strategy may subsequently be reviewed and discussed with the clinician during follow-up appointments. The website's participatory development process, youth-friendly design, accessible language, and engaging formats enhance its suitability for the target groups, including those who may find conventional text-based resources difficult to engage with.

Beyond clinical care, web-based psychoeducation may also be valuable in contexts such as schools and community programs, offering a scalable way to increase access to information and promote early help-seeking. Taken together, the use of web-based psychoeducation represents a promising approach to enhancing depression literacy among adolescents, making it a valuable tool in clinical practice as well as in other diverse contexts.

Data transparency

This article has not been published and is not under consideration for publication elsewhere. The authors do not have any previously published or currently in-press works stemming from this same dataset. The data reported have been previously presented in three research presentations at two national and one international academic conference with brief abstracts (without the main numerical results) published for each presentation.

Funding

This work was supported by the Prof. Otto Besheim Stiftung (Germany).

CRediT authorship contribution statement

Gerd Schulte-Körne: Writing – review & editing, Conceptualization. **Ellen Greimel:** Writing – review & editing, Supervision, Investigation, Conceptualization. **Regine Primbs:** Writing – review & editing, Investigation, Data curation, Conceptualization. **Kloek Maria Willemina Henriette:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation. **Lucia Iglhaut:** Writing – review & editing, Investigation, Data curation. **Sara Kaubisch:** Writing – review & editing, Investigation, Data curation. **Pia-Marie Keim:** Writing – review & editing, Investigation, Data curation. **Piechaczek Charlotte Elisabeth:** Writing – review & editing, Conceptualization. **Lisa Feldmann:** Writing – review & editing, Conceptualization. **Carolin Zsigo:** Writing – review & editing, Formal analysis.

Declaration of Competing Interest

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

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.pec.2025.109429.

References

[1] Rohde P, Lewinsohn PM, Klein DN, Seeley JR, Gau JM. Key characteristics of major depressive disorder occurring in childhood, adolescence, emerging adulthood, and adulthood. Clin Psychol Sci 2013;1:41–53. https://doi.org/10.1177/2167702612457599.

[2] Benjet C, Albor YC, Bocanegra ES, Borges G, Méndez E, Casanova L, et al. Incidence and recurrence of depression from adolescence to early adulthood: a longitudinal follow-up of the Mexican Adolescent Mental Health Survey. J Affect Disord 2020;263:540–6. https://doi.org/10.1016/j.jad.2019.11.010.

[3] Reis BF, Brown LG. Reducing psychotherapy dropouts: maximizing perspective convergence in the psychotherapy dyad. Psychother Theory Res Pr Train 1999;36:123–36. https://doi.org/10.1037/h0087822.

[4] Thapar A, Eyre O, Patel V, Brent D. Depression in young people. Lancet 2022;400:617–31. https://doi.org/10.1016/S0140-6736(22)01012-1.

[5] Clayborne ZM, Varin M, Colman I. Systematic review and meta-analysis: adolescent depression and long-term psychosocial outcomes. J Am Acad Child Adolesc Psychiatry 2019;58:72–9. https://doi.org/10.1016/j.jaac.2018.07.896.

[6] Finning K, Ukoumunne OC, Ford T, Danielsson-Waters E, Shaw L, Romero De Jager I, et al. The association between child and adolescent depression and poor

attendance at school: a systematic review and meta-analysis. J Affect Disord 2019; 245:928–38. https://doi.org/10.1016/j.jad.2018.11.055.
[7] Lu W. Adolescent depression: national trends, risk factors, and healthcare disparities. Am J Health Behav 2019;43:181–94. https://doi.org/10.5993/AJHB.43.1.15.
[8] Smith D, Jones I, Simpson S. Psychoeducation for bipolar disorder. Adv Psychiatr Treat 2010;16:147–54. https://doi.org/10.1192/apt.bp.108.006403.
[9] Colom F. Keeping therapies simple: psychoeducation in the prevention of relapse in affective disorders. Br J Psychiatry 2011;198:338–40. https://doi.org/10.1192/bjp.bp.110.090209.
[10] Jorm AF, Korten AE, Jacomb PA, Christensen H, Rodgers B, Pollitt P. Mental health literacy: a survey of the public's ability to recognise mental disorders and their beliefs about the effectiveness of treatment. Med J Aust 1997;166:182–6.
[11] Jorm AF. Mental health literacy: empowering the community to take action for better mental health. Am Psychol 2012;67:231–43. https://doi.org/10.1037/a0025957.
[12] Tursi MFdS, Baes CvW, Camacho FRdB, Tofoli SMdC, Juruena MF. Effectiveness of psychoeducation for depression: a systematic review. Aust N Z J Psychiatry 2013; 47:1019–31. https://doi.org/10.1177/0004867413491154.
[13] Duggal HS. Self-management of depression: beyond the medical model. Perm J 2019;23. https://doi.org/10.7812/TPP/18-295.
[14] Bevan Jones R, Thapar A, Stone Z, Thapar A, Jones I, Smith D, et al. Psychoeducational interventions in adolescent depression: a systematic review. Patient Educ Couns 2018;101:804–16. https://doi.org/10.1016/j.pec.2017.10.015.
[15] Pretorius C, Chambers D, Cowan B, Coyle D. Young people seeking help online for mental health: cross-sectional survey study. JMIR Ment Health 2019;6:e13524. https://doi.org/10.2196/13524.
[16] Bawden D, Holtham C, Courtney N. Perspectives on information overload. Aslib Proc 1999.
[17] Kessels RPC. Patients' memory for medical information. J R Soc Med 2003;96: 219–22. https://doi.org/10.1177/014107680309600504.
[18] Friedman AJ, Cosby R, Boyko S, Hatton-Bauer J, Turnbull G. Effective teaching strategies and methods of delivery for patient education: a systematic review and practice guideline recommendations. J Cancer Educ 2011;26:12–21. https://doi.org/10.1007/s13187-010-0183-x.
[19] Turner C, Turner KD. The effects of educational delivery methods on knowledge retention. J Educ Bus 2017;92:201–9. https://doi.org/10.1080/08832323.2017.1331989.
[20] Bevan Jones R, Thapar A, Rice F, Beeching H, Cichosz R, Mars B, et al. A web-based psychoeducational intervention for adolescent depression: design and development of MoodHwb. JMIR Ment Health 2018;5:e13. https://doi.org/10.2196/mental.8894.
[21] Radovic A, Li Y, Landsittel D, Odenthal KR, Stein BD, Miller E. A social media website (Supporting Our Valued Adolescents) to support treatment uptake for adolescents with depression or anxiety: pilot randomized controlled trial. JMIR Ment Health 2022;9:e35313. https://doi.org/10.2196/mental.9441.
[22] Bevan Jones R, Thapar A, Rice F, Mars B, Agha SS, Smith D, et al. A digital intervention for adolescent depression (MoodHwb): mixed methods feasibility evaluation. JMIR Ment Health 2020;7:e14536. https://doi.org/10.2196/14536.
[23] Schulte-Körne G, Klingele C, Zsigo C, Kloek M. The German S3 guideline for depressive disorders in childhood and adolescence: new developments [S3-Leitlinie Depressive Störungen im Kindes- und Jugendalter: wo geht es hin? Bundesgesundheitsbl Gesundh Gesundh 2023;66:767–73. https://doi.org/10.1007/s00103-023-03721-4.
[24] Margraf J, Cwik JC, Pflug V, Schneider S. Structured clinical interviews for mental disorders across the life span: psychometric quality and further developments of the DIPS Open Access Interviews [Strukturierte klinische Interviews zur Erfassung psychischer Störunger: Gutekriterien und Weiterentwicklungen der DIPS-Verfahren. Z Klin Psychol Psychother]. Z Klin Psychol Psychother 2017;46:176–86. https://doi.org/10.1026/1616-3443/a000430.
[25] World Health Organization. The ICD-10 classification of mental and behavioural disorders: clinical descriptions and diagnostic guidelines. Geneva: World Health Organization; 1992.
[26] Kühner C, Bürger C, Keller F, Hautzinger M. Reliability and validity of the revised Beck Depression Inventory (BDI-II) [Reliabilität und Validität des revidierten Beck-Depressionsinventars (BDI-II)]. Nervenarzt 2007;78(6):651.
[27] Kuhn J-T, Holling H, Freund PA. Giftedness diagnostics with the basic intelligence test (CFT 20-R): psychometric properties and measurement equivalence [Begabungsdiagnostik mit dem Grundintelligenztest (CFT 20-R) Psychometrische Eigenschaften und Messäquivalenz. Diagnostica 2008;54:184–92.
[28] Lampert T, Hoebel J, Kuntz B, Müters S, Kroll LE. Socioeconomic status and subjective social status measurement in KiGGS Wave 2. J Health Monit 2018;3: 108–25. https://doi.org/10.17886/RKI-GBE-2018-033.
[29] Ruble AE, Leon PJ, Gilley-Hensley L, Hess SG, Swartz KL. Depression knowledge in high school students: effectiveness of the Adolescent Depression Awareness Program. J Affect Disord 2013;150:1025–30. https://doi.org/10.1016/j.jad.2013.05.033.
[30] Hart SR, Kastelic EA, Wilcox HC, Beaudry MB, Musci RJ, Heley KM, et al. Achieving depression literacy: the Adolescent Depression Knowledge Questionnaire (ADKQ). Sch Ment Health 2014;6:213–23. https://doi.org/10.1007/s12310-014-9120-1.
[31] Alexandre B, Reynaud E, Osiurak F, Navarro J. Acceptance and acceptability criteria: a literature review. Cogn Technol Work 2018;20:165–77. https://doi.org/10.1007/s10111-018-0459-1.
[32] Thielsch M., Moshagen M. VisAWI Manual (Visual Aesthetics of Websites Inventory) and the short form VisAWI-S (Short Visual Aesthetics of Websites Inventory). 2015.
[32] Murrar S, Brauer M. Mixed model analysis of variance. The SAGE Encyclopedia of Educational Research, Measurement, and Evaluation. Thousand Oaks, CA: SAGE Publications; 2018. p. 1075–8.
[33] Brysbaert M, Stevens M. Power analysis and effect size in mixed effects models: a tutorial. J Cogn 2018;1:9. https://doi.org/10.5334/joc.10.
[34] Dostál J. Theory of problem solving. Procedia Soc Behav Sci 2015;174:2798–805. https://doi.org/10.1016/j.sbspro.2015.01.970.
[35] Cairns KE, Yap MB, Reavley NJ, Jorm AF. Identifying prevention strategies for adolescents to reduce their risk of depression: a Delphi consensus study. J Affect Disord 2015;183:229–38. https://doi.org/10.1016/j.jad.2015.05.019.
[36] Primbs R, Feldmann L, Iglhaut L, Allgaier A-K, Schulte-Körne G, Greimel E. Evaluation of an information booklet for adolescents on depression: evidence from a randomized controlled study. Child Adolesc Psychiatry Ment Health 2023;17:65. https://doi.org/10.1186/s13034-023-00614-x.
[37] Jiang Z, Wang W, Tan BCY, Yu J. The determinants and impacts of aesthetics in users' first interaction with websites. J Manag Inf Syst 2016;33:229–59. https://doi.org/10.1080/07421222.2016.1172443.
[38] Pengnate S, Sarathy R, Lee J. The engagement of website initial aesthetic impressions: an experimental investigation. Int J Hum Comput Inter 2018;35: 1517–31. https://doi.org/10.1080/10447318.2018.1554319.
[39] Semkovska M, Quinlivan L, O'Grady T, Johnson R, Collins A, O'Connor J, et al. Cognitive function following a major depressive episode: a systematic review and meta-analysis. Lancet Psychiatry 2019;6:851–61. https://doi.org/10.1016/S2215-0366(19)30291-3.
[40] Kutcher S, Wei Y, Coniglio C. Mental health literacy: past, present, and future. Can J Psychiatry 2016;61:154–8. https://doi.org/10.1177/0706743715616609.