Mentalization Training Through Expressive Writing: Investigating Its Effects on Stress Levels Using Ecological Momentary Assessment and an AB Within-subject Design

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Abstract

Young adulthood is a period marked by new challenges and increasing demands for independent stress regulation. This highlights the need for scalable, self-guided interventions. This study tested whether a one-week, smartphone-delivered mentalization-based expressive writing task could reduce stress and improve mentalization and self-efficacy. Eight participants (aged 18–29) completed a two-week within-person AB design intervention: during both weeks, they responded to five ecological momentary assessment (EMA) prompts per day, and in Week B they additionally completed one daily 5–10 minute expressive writing session focused on mentalization. At each EMA prompt, participants rated their current levels of stress, mentalization, and self-efficacy using single-item visual analogue sliders. Data were analyzed using linear mixed-effects models and individual-level contrasts. Writing adherence was high. what was found was that there were no immediate improvements following the writing sessions. Post-writing scores for stress ($b = 1.72$, $p = .58$), mentalization ($b = –0.20$, $p = .93$), and self-efficacy ($b = 0.03$, $p = .99$) showed no significant change, indicating that participants did not experience short-term psychological benefits directly after engaging in the task. Looking at the broader effect across the entire writing week, stress levels remained stable ($b = –0.03$, $p = .98$), but both mentalization and self-efficacy declined significantly ($b = –4.59$, $p < .01$; $b = –5.48$, $p < .01$), suggesting potential cumulative negative effects over time. Individual patterns varied, with some participants improving while others worsened. These findings suggest that a brief, unguided mentalization-through-writing task may be insufficient and in some cases counterproductive for decreasing stress. Future studies should explore longer, guided protocols and less intensive EMA schedules to determine for whom, and under what conditions, such interventions are most effective.

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Young adulthood is a period marked by mounting emotional and social challenges. Each year almost half of young adults meet diagnostic criteria for a mental disorder, with anxiety and depression leading the list (Kessler et al., 2005). Stressors such as academic pressure, financial insecurity, and social comparison further decrease emotional stability and self-confidence (Keles et al., 2019; Matud et al., 2020). These challenges undermine the very skills needed to form intimacy—and when those skills are insufficient, the risk of isolation rises. According to Erikson's psychosocial theory, stage 6—young adulthood (19–29)—is defined by the developmental challenge of *intimacy versus isolation* (Prep, 2023). It is a phase in which people are expected to build close, meaningful relationships while also figuring out who they are as independent adults. Doing so requires the ability to recognise and manage one's own emotions, understand others, and stay confident under growing responsibilities. Strengthening core emotional capabilities is therefore critical at this life stage, and one capacity that appears especially relevant is mentalization. Mentalization refers to the ability to make sense of one's own thoughts and feelings, as well as those of others. When people can make sense of their own thoughts and feelings, and properly interpret those of others, they can down regulate stress at the moment, choose helpful coping strategies, and maintain empathic and supportive relationships (Luyten et al., 2020). Because these abilities are directly mapped to the intimacy-isolation task, training programs that reinforce mentalization offer a developmentally precise way to help young adults stay connected and self-confident.

Mentalization-based training (MBT) is best known from clinical contexts: it reliably improves emotional insight and interpersonal functioning in people with complex conditions such as borderline personality disorder (Fleisher, 2018; Luyten & Fonagy, 2015). Recent work shows similar benefits in non-clinical populations. A systematic review found that school-based mentalization interventions boost socio-emotional skills and positive behaviour in adolescents Chelouche-Dwek and Fonagy (2024), while another study showed that higher mentalization mediates lower depressive symptoms among university students (Solervicens et al., 2024). Together, these findings indicate that enhancing mentalization could be valuable for the broader young-adult population as they learn to manage stress and emotional demands.

Mentalization does not act in isolation. Longitudinal evidence shows that stronger mentalizing predicts higher momentary self-efficacy and, in turn, lower perceived stress six months later (Solervicens

et al., 2024). Self-efficacy is the belief in one's capacity to handle challenges (Luszczynska et al., 2005). This is in itself a robust buffer against stress and a driver of adaptive coping in young adults (Liu et al., 2024; Sharma, 2023). Conceptually, mentalization provides the *insight* ("I understand why I feel anxious") that enables self-efficacy to supply the *agency* ("... and I believe I can deal with it"). When this insight loop is working properly, stress tends to reduce. Because stress, self-efficacy, and mentalization are tightly intertwined, they form a coherent framework for studying how young adults cope with everyday pressures and for testing interventions designed to strengthen that framework.

According to Luyten et al. (2020) Mentalization exists as a construct which includes four dimensions: automatic versus controlled, cognitive versus affective, internally versus externally focused, and self- versus other-oriented. The framework explains how mentalization enables people to observe their emotions objectively, thus reducing automatic stress responses and enabling better coping mechanisms (Luyten et al., 2020)). People who practice mentalization tend to develop better coping strategies through reframing negative situations. Mentalization-based interventions which originally targeted clinical populations now show growing importance for treating non-clinical populations. Professional treatment is not within reach for stressed individuals, yet they can gain advantages through organized psychological interventions. The success of digital mental health solutions demonstrates that low-cost psychological interventions can be implemented in non-traditional healthcare environments in subclinical populations (Cameron et al., 2024; Edge et al., 2023). This suggests that mentalization techniques could be adapted into self-guided interventions, for example by approaches like expressive writing.

Full MBT programmes involve weekly face-to-face sessions with trained professionals, which can be effective but are often time-consuming and resource-intensive. For students balancing coursework, part-time jobs, and social obligations, this kind of structured support may not always be practical or necessary. In this context, expressive writing offers a useful, low-threshold alternative. Originally developed by Pennebaker, the exercise involves spending about 15–20 minutes writing openly about a meaningful or emotionally relevant experience, with the focus placed on emotional insight rather than grammar or style (Pennebaker, 2016). Because writing prompts guide attention toward thoughts, feelings, and social context, they activate many of the same reflective processes targeted in formal mentalization training, just in a lighter and more flexible form. It's a format that fits easily into a student's daily routine and could be completed in the time usually spent scrolling a phone. In that sense, expressive writing

represents a pragmatic and scalable way to support emotional skills without requiring intensive intervention.

The empirical record is encouraging. A meta-analysis of 146 experimental disclosure studies found small but reliable benefits of expressive writing across psychological, physical, and functional domains (Frattaroli, 2006). Subsequent work shows that these gains often unfold with a delay but persist over months, including reductions in stress, anxiety, and depression (Guo, 2022). Among university students, expressive writing has been linked to lower exam anxiety, reduced threat appraisals, and cortisol declines (Ringeisen et al., 2018). Systematic reviews confirm small yet sustained boosts in self-efficacy across academic and health settings (Baikie & Wilhelm, 2005), and a dedicated meta-analysis demonstrates particular effectiveness for young-adult samples (Travagin et al., 2015). Taken together, these findings suggest that expressive writing may offer a low-cost, non-clinical way to strengthen key skills linked to mentalization, self-efficacy, and stress reduction. This makes it a suitable method for exploring how brief, reflective interventions can support young adults meeting the intimacy–isolation challenge.

While expressive writing and mentalization have each been studied extensively on their own, there is a noticeable lack of research examining how these methods might work together. The approach of mentalization develops mental flexibility and self-understanding while expressive writing creates an organized environment for emotional contemplation. These intervention methods could potentially work well when combined. The controlled processing of emotional experiences in expressive writing shown by Baikie and Wilhelm (2005) matches key elements of mentalization. The research by Frattaroli (2006) demonstrates that expressive writing increases both self-awareness and emotional clarity.

A strong set of assessment tools is necessary to evaluate the success of such interventions. Standard questionnaires have two major drawbacks because they depend on memory recall from participants and they cannot measure emotional changes during different periods of the day. The Ecological Momentary Assessment (EMA) method serves as an alternative approach which gathers real-time information from participants in their everyday settings. The study by Baars et al. (2022) demonstrates that EMA successfully monitors immediate psychological alterations specifically among students. Mobile EMA tools both enhance self-regulation and user engagement through their immediate feedback system. The assessment method delivers both superior ecological validity along with cost-effective scalability to track emotional responses throughout time.

To make full use of the advantages of EMA, it is important to adopt a study design that captures changes at the individual level. While traditional designs often rely on group-level averages, EMA allows for the observation of within-person fluctuations over time, providing insight into how psychological variables like stress, mentalization, and self-efficacy change in real-world contexts. This approach is particularly useful for studying stress regulation, where coping strategies and emotional responses can differ widely between individuals (McDonald et al., 2017). Recent research by Konigorski et al. (2024) highlights how digital tools can support repeated, in-the-moment assessments, enabling a more dynamic understanding of psychological processes. By combining EMA with a repeated-measures design, the current study aims to capture these time-sensitive effects across individuals, offering a more nuanced picture of intervention impact than cross-sectional or pre-post designs typically allow.

While MBT has been shown to improve emotion regulation in clinical and non-clinical samples, and expressive writing has demonstrated benefits for stress reduction in student populations, no study has yet tested whether a digital, mentalization-focused writing task can simultaneously impact stress, mentalization, and self-efficacy in everyday life. By combining smartphone-based expressive writing with EMA in an AB within-subject design, the present study addresses this methodological gap and provides detailed, within-person insight into how and when mentalization-through-writing may be effective.

Building on this framework, the current study examines whether a brief mentalization-based expressive writing intervention can influence three key areas: stress, self-efficacy, and mentalization. These constructs were selected because they each play a central role in how young adults manage everyday emotional demands. Stress captures immediate pressure, self-efficacy reflects one's confidence in handling that pressure, and mentalization underpins both by helping individuals make sense of their own and others' mental states. Strengthening mentalization may therefore offer a pathway to reduce stress and enhance a sense of control in this population.

Based on this framework, the following hypothesis was tested:

1. A mentalization-based expressive writing intervention will reduce stress and increase mentalization and self-efficacy in young adults.

Methods

This study examined whether a mentalization-based expressive writing intervention could influence stress, mentalization, and self-efficacy in young adults. The research used EMA to track individual within-person changes across two weeks. This study targeted a small, non-clinical group to test whether the design was practical and to explore how individuals emotions and thoughts changed throughout the day.throughout the day.

Participants

Participants were young adults recruited via a combination of convenience sampling and a screening questionnaire distributed through the University of Twente's SONA system. The SONA system is the university's online research participation platform, which allows students to sign up for studies in exchange for course credit or other compensation. To be eligible, participants had to be between 18 and 29 years old and own a smartphone capable of receiving notifications.

The screening survey assessed perceived stress, mentalization, and self-efficacy using validated questionnaires. Participants were selected based on scoring relatively high on stress and relatively low on mentalization and self-efficacy, in order to include individuals who might benefit most from a mentalization-based intervention. The study aimed to recruit between six and eight participants, which was considered appropriate given its exploratory nature and the practical demands of collecting real-time data through EMA.

Eight participants were ultimately included (3 female, 5 male; mean age = 23.0, SD = 1.45, range = 20–25). Six were students and two were employed. The sample was sufficient to pilot the procedures and test feasibility using the Twente Intervention Machine (TIIM) mobile platform for EMA. The design allowed for repeated within-subject observations across time, enabling detailed exploratory analyses of individual patterns.

Ethical approval for this study was granted by the BMS Ethics Committee / Domain Humanities & Social Sciences at the University of Twente (Ref. 250286). All participants provided informed consent digitally. They were informed of their right to withdraw at any time without consequences and could contact the researcher directly. General study information remained accessible within the TIIM app throughout the study, and participants could skip any item they preferred not to answer.

Procedure

The study followed a two-week AB within-subject design in which each participant completed both a control phase and an intervention phase. In the first week (A), participants received only EMA prompts. In the second week (B), they continued to receive EMA prompts and were also given a daily expressive writing task intended to provoke mentalization.

Before the start of the study, participants completed an online intake form and attended a short onboarding session, either in person or online. This session was guided by a standardized script, see Appendix F. During this session, they were informed about the study, gave written consent, and were guided through the installation and setup of the TIIM app, which was used to deliver all study prompts. Participants were also asked to indicate time periods during the day when they did not want to receive notifications. This information was used to tailor the EMA delivery schedule to each participant's daily rhythm while ensuring that prompts remained evenly spaced throughout their available hours.

During both weeks of the study, participants received five EMA prompts per day on their smartphones. Prompts were sent at semi-random times that were evenly spaced throughout each participant's waking hours. This approach maintained both temporal coverage and the unpredictability necessary for high-quality EMA data (Shiffman et al., 2008). Each prompt was available for ten minutes after being sent and expired if not answered within that time. This limited response window was intended to minimize recall bias but also reflects a technical limitation of the TIIM platform since this window cannot be adjusted. All responses were collected directly through the app.

In the second week, participants also received a daily expressive writing prompt at 18:00 via the TIIM app. These writing tasks were designed to promote mentalization by encouraging reflection on emotions, thoughts, and social interactions. Each writing prompt remained available until 23:59. Participants were asked to write for five to ten minutes without focusing on grammar or spelling, and they were assured that their entries would not be read or stored, as the goal was not to analyze content but to examine the effect of mentalization through expressive writing on stress, self-efficacy, and mentalization itself. The app automatically recorded writing duration each day so that engagement could be tracked.

Materials

Screening Instruments.

- **Perceived Stress Scale (PSS-10).** The PSS-10 (Cohen & Williamson, 1988) is a 10-item questionnaire that assesses how unpredictable, uncontrollable, and overloaded participants perceive their lives to be. Items are rated on a 5-point Likert scale from 0 (*never*) to 4 (*very often*), with higher scores indicating greater perceived stress. The original scale has demonstrated strong internal consistency (Cronbach's α = .89).

- **Mentalization Questionnaire (MZQ).** The MZQ (Hausberg et al., 2012) consists of 15 items assessing mentalization capacity, rated on a 5-point Likert scale from 1 ("I disagree") to 5 ("I agree"). All items were reverse-scored so that higher scores indicate greater mentalization ability. The total score was computed as the mean of all 15 items. The questionnaire includes four subscales: Rejection of Self-Reflection, Emotional Awareness, Psychic Equivalence, and Regulation of Affect. However, only the total score was used in this study. Internal consistency reported in the original validation was α = .81. See Appendix B.

- **General Self-Efficacy Scale (GSE).** The GSE (**schwarzer1995**) is a 10-item scale measuring beliefs in one's ability to handle difficult or unexpected situations. Items are rated on a 4-point Likert scale from 1 ("Not at all true") to 4 ("Exactly true"), yielding a total score range of 10 to 40, with higher scores indicating greater perceived self-efficacy. The original scale reported strong internal consistency (Cronbach's α = .86). See Appendix C.

Ecological Momentary Assessment

The full EMA item set was based on the University of Twente Experience Sampling Core Questionnaire (UTESCQ) Appendix D. However, for the current analysis, only three items were selected to represent key constructs of interest: perceived stress and two indicators of mentalization. These items are shown in Table 1. Responses were recorded on a 5-point Likert scale for stress and a 1–100 visual analogue scale for mentalization.

Table 1

Ecological Momentary Assessment Items Included in the Current Analysis

EMA Item	Response Scale	Measured Construct
At this moment, I feel stressed.	1 to 100 (Visual analogue scale)	Perceived Stress
At this moment, I understand how I feel.	1 to 100 (Visual analogue scale)	Momentary Mentalization
At this moment, I am confident that I can deal with upcoming tasks.	1 to 100 (Visual analogue scale)	Self-Efficacy

Mentalization through expressive writing prompts

During week B participants received seven mentalization-based writing prompts, one each day, via TIIM. These prompts were designed to engage the four dimensions of mentalization. Participants were informed that their written responses would not be analyzed for content (Luyten et al., 2020). A detailed list of the prompts and daily instructions can be found in Appendix E

Data Analysis

All analyses were conducted in R (version 4.5.0). To examine how participant's stress, mentalization, and self-efficacy changed over the two-week study, linear mixed-effects models (LMMs) were applied using the `lme4` package. These models are well-suited for repeated-measures data like EMA because they can account for individual differences while examining overall trends. Each outcome was measured through a single EMA item:

- **Stress:** At this moment, I feel stressed.
- **Mentalization:** At this moment, I understand how I feel.
- **Self-efficacy:** At this moment, I am confident that I can deal with upcoming tasks.

For each of the three outcomes—stress, mentalization, and self-efficacy—a separate linear mixed-effects model was estimated. These models included three fixed effects: (1) **Post-Writing**, a binary variable capturing whether the EMA entry occurred immediately after an expressive writing task (0 = no, 1 = yes), which tests the acute effect of the intervention; (2) **Treatment**, a binary variable indicating whether the entry occurred during week A or week B, representing gradual week-level change; and (3) **Prompt**, a

numeric variable (1–5) indicating the order of daily EMA prompts, used to account for time-of-day trends. A random intercept for each participant was included. This allows the model to estimate change while accounting for individual differences.

The model was estimated in R using the following formula:

```
lmer(outcome ~ Post_Writing + Week + Prompt + (1 | Participant_ID), data = my_data)
```

This corresponds to the following linear mixed-effects model:

$$Y_{ij} = \beta_0 + \beta_1 \cdot \text{PostWriting}_{ij} + \beta_2 \cdot \text{Treatment}_{ij} + \beta_3 \cdot \text{Prompt}_{ij} + u_{0j} + \varepsilon_{ij}$$

Where:

- Y_{ij} is the outcome (stress, self-efficacy, or mentalization) for participant j at timepoint i,
- β_1 captures the acute effect of expressive writing,
- β_2 captures the slower control to intervention week drift,
- β_3 captures trends across the order of prompts within a day (from first to last entry),
- $u_{0j} \sim N(0, \sigma_u^2)$ is the random intercept for participant j, and
- $\varepsilon_{ij} \sim N(0, \sigma^2)$ is the residual error term.

EMA research recommends excluding participants with less than 60% compliance in this study (Shiffman et al., 2008). To ensure data reliability, and due to the small sample size, no participants were excluded from the primary analysis in this study. This decision was made to preserve statistical power and reflect the full variability of participant engagement. To address potential concerns about low compliance, a sensitivity analysis was conducted in which participants below the 60% compliance threshold were excluded. This allowed for an assessment of whether findings remained consistent when limited to higher-quality data.

To visualize the results, `ggplot2` was used to create boxplots for comparing scores between the control and intervention weeks, and a ggplot was generated to visualize the score trends over the study period.

The AB within subject design required the following additional analyses. For each participant, average scores in the control and intervention phases were calculated for all three outcomes. These summaries were used to explore how each individual responded to the intervention and if the change was in the same direction for all participants.

The TIIM app automatically recorded the writing durations to asses engagement with the expressive writing tasks. The average writing time per session was calculated for each participant to see if they followed the 5–10 minute instruction and to check if they were consistent in their engagement.

The assumptions of the linear mixed-effects models were checked to ensure the validity of the analyses. Residual plots for stress, mentalization, and self-efficacy were examined to assess linearity and the consistency of residual variance across fitted values

The assumptions of the linear mixed-effects models were checked to ensure valid interpretation of the results. Visual inspection of residual and Q-Q plots is a widely recommended method for assessing model assumptions such as linearity, homoscedasticity, and normality of residuals (Field, 2016).

Results

Descriptive statistics

Table 2 summarizes the demographic characteristics and EMA compliance rates of the eight participants included in the study. Ages ranged from 20 to 25, with a mix of students and working young adults. Compliance, defined as the percentage of completed ecological momentary assessments (out of a possible 70), varied across participants.

This corresponds to individual compliance rates ranging from 31% to 84%, with a mean compliance rate of approximately 68%. Two participants had a compliance rate below 60%—a commonly used threshold in EMA research (Shiffman et al., 2008). When excluding those two participants, the remaining six showed compliance rates between 63% and 84% (M = 74%).

Table 2

Descriptive Characteristics of Participants

Participant	Age	Gender	Occupation	Compliance (%)
1	20	Female	Student	75.7
2	25	Male	Student	65.7
3	24	Female	Working	84.2
4	23	Male	Student	78.6
5	23	Male	Student	77.1
6	24	Female	Student	62.9
7	24	Male	Working	37.1
8	22	Male	Student	31.4

Fixed Effects from Linear Mixed-Effects Models

Table 3 summarizes the fixed effects from the linear mixed-effects models. No significant immediate effects of expressive writing (*Post-Writing*) were found for any outcome. However, significant decreases in self-efficacy and mentalization were observed during the treatment period compared to the control phase. Specifically, both constructs declined moderately, while stress levels remained stable.

Self-efficacy also showed a significant increase across the day (*Prompt*), indicating that participants

felt more capable later in the day. No such time-of-day trends were detected for stress or mentalization.

Table 3

Fixed Effects from Linear Mixed-Effects Models (including 95 % confidence intervals)

Outcome	Predictor	b (Unstd)	b (Std)	SE	*t*	95% CI
Stress	Intercept	33.10	0.02	5.77	5.74	21.82–44.43
	Post-Writing	1.72	0.02	2.96	0.58	-4.07–7.52
	Treatment	-0.03	0.00	1.79	-0.02	-3.53–3.47
	Prompt	-0.90	-0.05	0.69	-1.32	-2.25–0.44
Self-Efficacy	Intercept	72.40	-0.06	5.34	13.60	61.91–82.83
	Post-Writing	0.03	0.00	2.21	0.01	-4.31–4.37
	Treatment	**-5.48**	**-0.15**	1.34	**-4.09**	-8.10– -2.86
	Prompt	**1.26**	**0.09**	0.51	**2.45**	0.25–2.27
Mentalization	Intercept	74.50	-0.02	5.10	14.60	64.55–84.54
	Post-Writing	-0.20	0.00	2.13	-0.09	-4.37–3.98
	Treatment	**-4.59**	**-0.13**	1.29	**-3.57**	-7.12– -2.07
	Prompt	0.11	0.01	0.49	0.22	-0.86–1.08

Note. **Bold values** indicate statistically significant effects ($|t| > 2$). Intercepts are not emphasized.

Post-Writing reflects EMA scores following writing sessions.

Treatment compares outcome scores during the intervention week (Days 8–14) to the control week (Days 1–7).

Prompt captures within-day trends across the 5 daily EMA prompts (e.g., morning to evening).

Figure 1 shows boxplots of stress, self-efficacy, and mentalization scores separated by treatment (control vs. intervention). While visual differences are subtle, median scores were lower during the intervention week for self-efficacy and mentalization.

This suggests that during the intervention week, participants experienced slightly reduced self-efficacy and mentalization, while stress levels remained relatively unchanged.

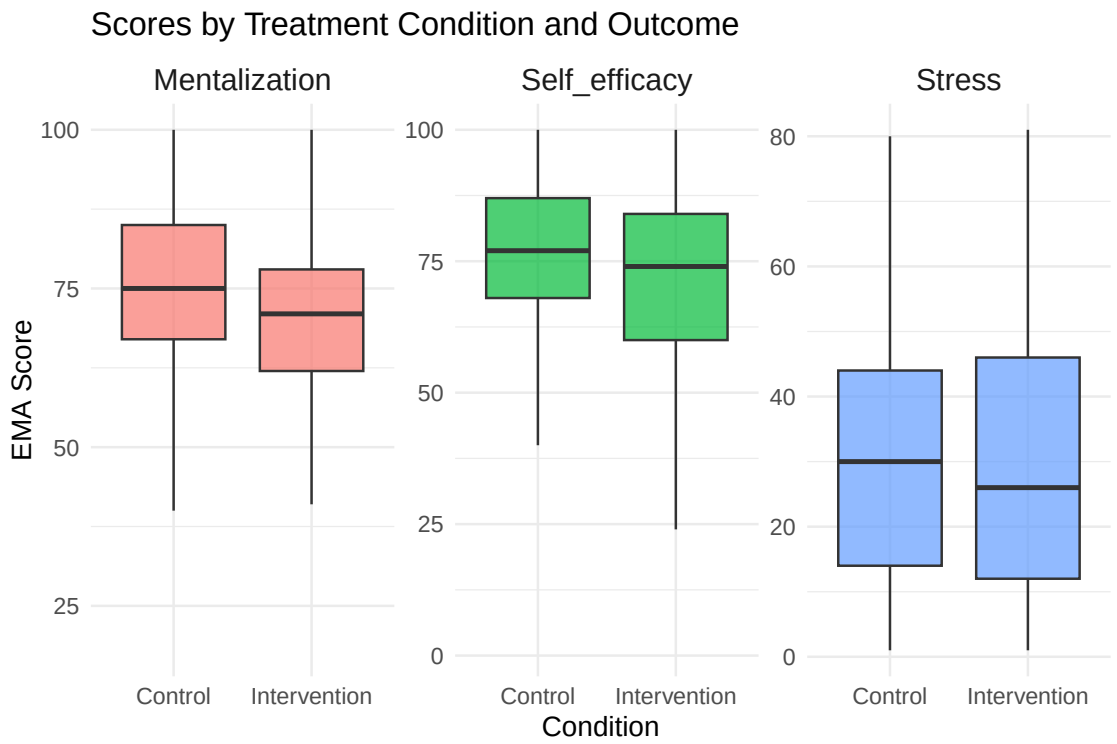

Figure 1

Boxplots of scores across control and intervention weeks for each outcome.

Figure 2 shows group-level smoothed trends for each outcome across the 14-day study. Shaded ribbons indicate ±1 SD. The intervention period (Days 8–14) is highlighted in purple.

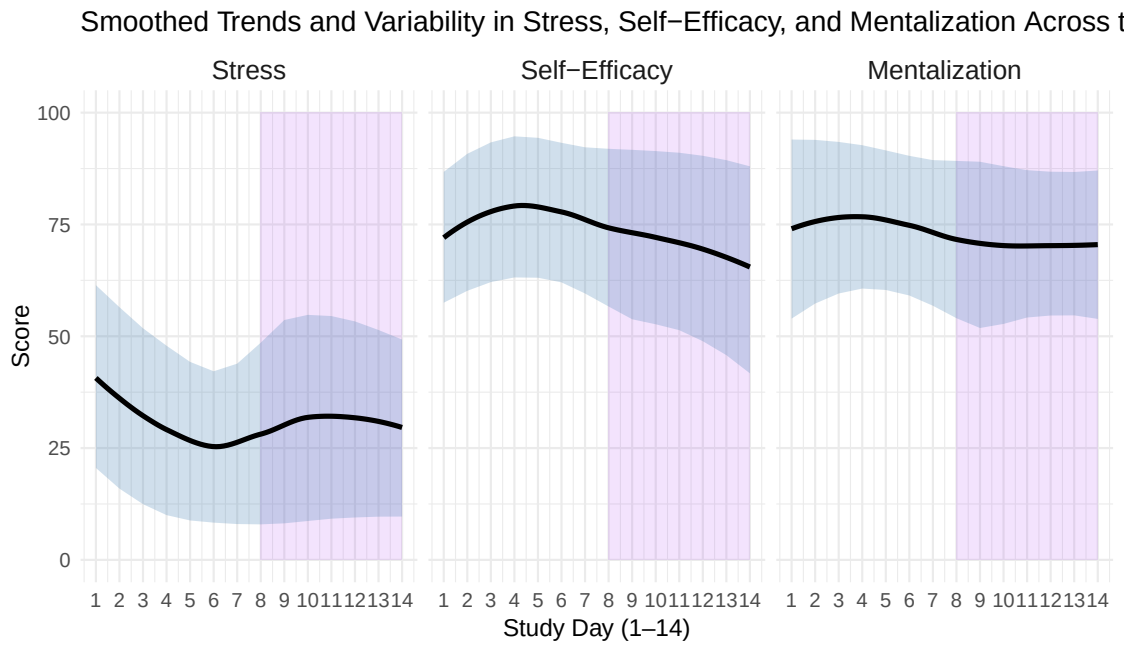

Figure 2

Daily trends in psychological scores during the 14-day study. Lines show smoothed averages; shaded bands reflect variability. The intervention period is shaded in purple.

Model Assumption Checks

The residuals for stress showed a reasonably random scatter without strong curvature or funnel shapes, indicating good model fit. Mentalization displayed a slight increase in residual spread at higher fitted values, suggesting mild heteroscedasticity. Self-efficacy showed a similar pattern, with a slightly wider residual range and one more pronounced outlier, but without evidence of strong nonlinearity.

Q–Q plots for all models indicated that residuals generally followed the expected normal distribution. Both self-efficacy and mentalization showed some deviation at the distributional extremes, slightly more so for mentalization, but no substantial violations of model assumptions were observed. Diagnostic plots are provided in Appendix G.

Individual Results

To examine person-specific effects, within-participant differences between the control and intervention phases were calculated for each outcome. These values, together with the associated *t*-tests, are reported in Table 4.

Table 4

Within-participant changes (Δ) and p-values for Stress, Mentalization, and Self-Efficacy

ID	Stress		Mentalization		Self-Efficacy	
	Δ	*p*	Δ	*p*	Δ	*p*
1	-5.57	**.002**	-1.29	.513	-0.81	.328
2	11.50	.062	-2.34	.639	-11.20	.087
3	-0.15	.948	-2.15	**.038**	-0.60	.344
4	17.40	**.001**	-0.14	.968	-16.00	**.001**
5	-15.80	**<.001**	-1.12	.518	0.38	.847
6	7.09	.086	-20.50	**<.001**	-17.30	**<.001**
7	-3.69	.403	-1.12	.634	5.62	.232
8	-11.30	.156	-16.20	**.016**	0.17	.976

Note. Δ = mean (intervention) – mean (control). Bold *p*-values indicate significance at $\alpha = .05$ (independent *t*-test per participant).

Figure 3 complements the table by plotting each participant's moment-to-moment scores over the 14-day study, with individual trend lines overlaid for stress, self-efficacy, and mentalization. While all participants completed the full two-week period, the number of EMA responses varied (Some completed close to 60 entries, others closer to 20). As a result, some lines end earlier than others, and more white space appears in participants with lower compliance even though they remained enrolled throughout the whole study.

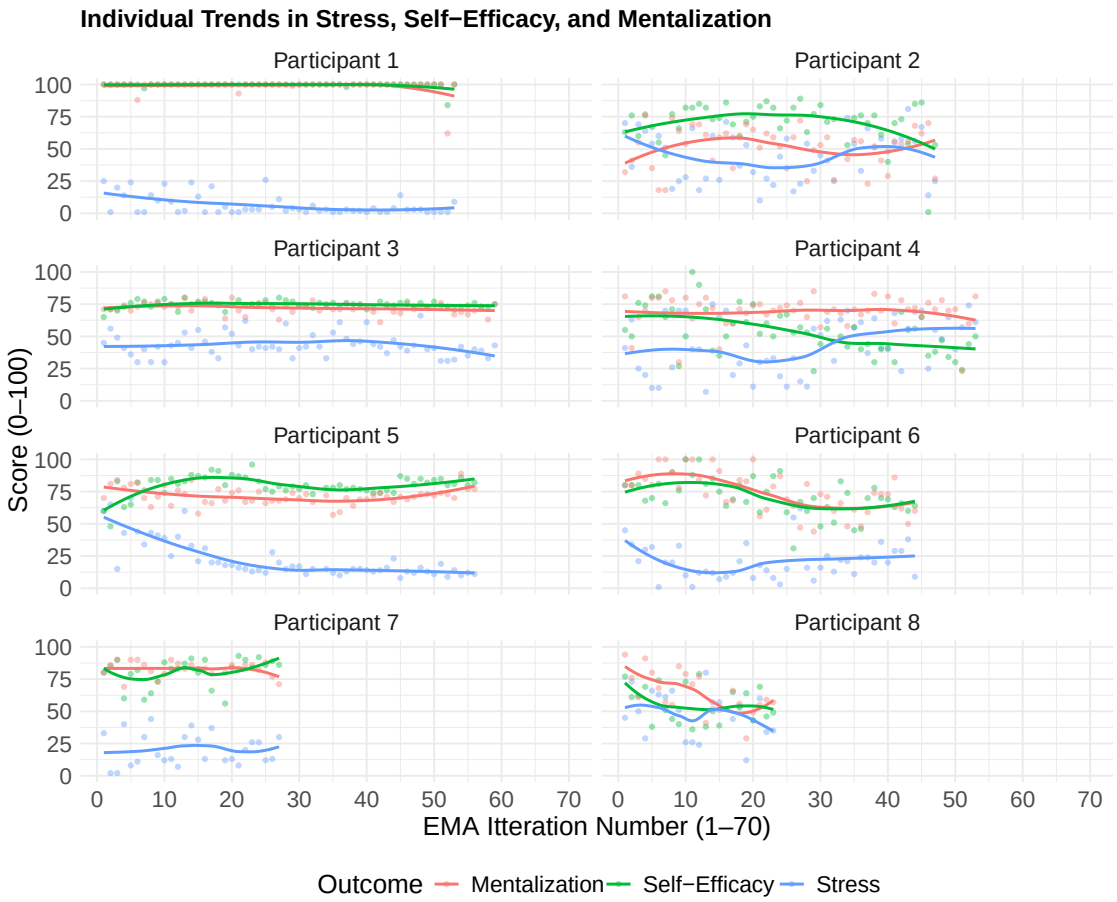

Figure 3

Individual trajectories for stress, self-efficacy, and mentalization. Each coloured line represents the smoothed trend for a single participant; dots mark the raw EMA scores.

Writing-Task Engagement

Writing engagement during the intervention week was assessed by analyzing the time each participant spent on the expressive writing tasks. The TIIM app automatically logged the duration (in seconds) of each writing session. Table 5 shows the individual writing durations across the seven intervention days for all eight participants.

Table 5

Writing Durations (Seconds) for Each Participant Across the Seven Intervention Days

Participant ID	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Average
1	156	300	456	235	245	334	390	302.29
2	204	322	766	505	–	277	190	377.33
3	538	284	339	316	–	263	305	340.83
4	743	732	387	519	602	–	592	595.83
5	494	427	–	594	356	242	295	401.33
6	533	566	–	–	252	–	435	446.50
7	170	–	–	360	–	–	220	250.00
8	458	–	387	455	694	348	–	468.40

Note. Dashes (–) indicate missing sessions. The extremely long entry of 4474 seconds was treated as an outlier and excluded from the average. Averages are calculated over available days only.

Most participants showed consistent engagement across the week, with writing durations typically falling within the instructed 5–10 minute range (i.e., 300 to 600 seconds). Only one participant (ID 7) averaged below this range across the week. Another participant (ID 6) recorded an unusually long entry of 4474 seconds on Day 4, which was treated as an outlier and excluded from the average duration calculations.

These engagement patterns suggest that participants generally adhered to the task guidelines, indicating they were sufficiently exposed to the intervention content. While missing entries and outliers were retained in the main analysis, they were flagged for interpretation purposes.

Sensitivity Analysis

To assess the robustness of the findings, the linear mixed-effects models were re-estimated after excluding the two participants with the lowest compliance (IDs 7 and 8). The results of this sensitivity analysis, presented in Appendix H, showed no meaningful changes in the pattern of findings. The significant treatment-related decreases in self-efficacy and mentalization remained significant, and the null findings for stress were consistent. These results suggest that the primary conclusions hold even when

excluding low-compliance cases.

Discussion

This study set out to examine whether a one-week mentalization-based expressive writing task could reduce stress and improve mentalization and self-efficacy in young adults, using a two-week AB within-subject design with EMA. However, the findings did not support this hypothesis. As shown in Table 3, the key finding was that immediately after each writing task (the post-writing variable), participants showed no reductions in stress or improvements in mentalization and self-efficacy. This is considered the most important result because the post-writing variable best captures the immediate psychological effects of the intervention itself. In contrast, the treatment-level effect likely reflects cumulative influences, particularly EMA burden. While no immediate benefits were seen after writing, both mentalization and self-efficacy declined across the intervention week, suggesting that participants may have been affected more by the overall study demands than by the writing itself. Interestingly, self-efficacy showed a slight upward trend across daily prompts, indicating a possible momentary boost linked to engagement or measurement reactivity.

Prior research on expressive writing and mentalization typically shows improvements in emotional regulation, self-reflection, and self-efficacy over time (Baikie & Wilhelm, 2005; Pennebaker, 2016). Based on this, stress was expected to decrease and mentalization and self-efficacy to increase. Stress remained unchanged, mirroring several recent trials that found no immediate benefit from brief, self-directed writing exercises (Hoult et al., 2025; Reinhold et al., 2018). A meta-analysis focused on intervention length supports the idea that benefits on perceived stress often emerge only after a two-week delay (Guo, 2022). Mentalization and self-efficacy declined at the group level. Although there is limited literature on adverse effects of expressive writing and mentalization, these studies suggest they can initially disrupt psychological stability.

One possible explanation for this pattern is the “distress paradox,” in which confronting difficult emotions leads to short-term discomfort before longer-term gains emerge (Frattaroli, 2006; Smyth, 1998). Participants may have activated unresolved or emotionally loaded material without having the tools or support to process it effectively. This could explain why self-efficacy decreased overall. At the same time, a small but significant increase in self-efficacy across prompts during the day was found. This pattern suggests that if the intervention had lasted longer than one week, self-efficacy may have stabilized or even increased. The initial decline followed by potential recovery points to a more complex, nonlinear process

in how young adults interact with self-reflection over time (Sharp et al., 2013).

Another possible explanation for the declines lies in two common psychological pitfalls of unguided introspection: hypermentalization and rumination. Hypermentalization refers to the tendency to over-interpret thoughts or intentions, which can reduce reflective clarity rather than enhance it. Although often studied in clinical populations (Sharp et al., 2013), hypermentalization has also been observed in non-clinical groups such as socially anxious young adults (Ballespí et al., 2019). Without professional guidance, participants in this study may have overanalyzed their own mental states, decreasing their capacity to mentalize accurately.

The drop in self-efficacy may also reflect the effects of rumination, a repetitive, self-critical style of thinking that tends to have negative effects on confidence/self-efficacy. Prior studies have linked rumination to lower emotional and academic self-efficacy, particularly in young adult populations (Lyubomirsky & Nolen-Hoeksema, 1995; Takano & Tanno, 2009). Without a clear structure or external support, participants may have focused too much on personal shortcomings or unresolved stressors, leading to a temporary loss of perceived control. Together, hypermentalization and rumination offer a plausible explanation for why the intervention may have backfired, at least in the short term. In addition, the study's intensive design, five semi-random EMA prompts per day with a ten-minute response window, likely placed extra time pressure on participants, which could have further decreased their sense of control and self-efficacy.

The individual-level analysis revealed several statistically significant within-person effects. As shown in Table 4 and Figure 3, stress significantly decreased for Participants 1 and 5, while Participant 4 showed a significant increase. For mentalization, three participants (3, 6, and 8) exhibited significant declines, with no significant improvements observed. Self-efficacy significantly declined in Participants 4 and 6, again with no evidence of improvement in others. These individual results largely mirror the group-level patterns: declines in mentalization and self-efficacy are consistent across both levels of analysis. However, stress showed greater variability across individuals, contrasting with the null group effect. These mixed trajectories underscore the value of combining EMA with a within-subject AB design to uncover individual dynamics that group means may obscure (Fisher et al., 2018). They also suggest that this type of unguided, self-reflective intervention may be beneficial for some individuals while potentially unhelpful or even harmful for others.

Such heterogeneity has been observed in prior research. In one study, only high engagement

participants, meaning those who wrote longer and more thoughtfully, showed meaningful improvement, while low engagers saw little to no benefit (Rude et al., 2023). Similarly, a recent work stress intervention found that writing outcomes differed by sex: men showed reduced exhaustion, but women did not (Lukenda et al., 2024). In another study, participants' baseline levels of emotional expressivity changed how they responded to the writing task: those who were more emotionally expressive experienced reduced anxiety, while those who were less expressive actually became more anxious (Niles et al., 2013). These findings highlight that group-level averages can mask important individual differences in response to writing interventions. Prior research suggests that meaningful engagement is more likely when participants are emotionally expressive, motivated to disclose, and adhere to the writing structure. These predictors have been consistently associated with better outcomes in expressive writing studies (Baikie & Wilhelm, 2005; Niles et al., 2013; Rude et al., 2023).

This study had several strengths. First, the use of EMA allowed for detailed, real-time tracking of stress, mentalization, and self-efficacy throughout daily life. Second, the single-case AB design meant each participant served as their own control, which increased sensitivity to subtle, within-person changes. Finally, adherence to the expressive writing task was high see Table 5. This suggests the protocol was both manageable and engaging. These strengths sit alongside limitations, each of which presents valuable insights and clear opportunities for refining future research

Several of these limitations directly shaped the study's outcomes and highlight where future work can build on these lessons. First, the EMA protocol itself may have increased stress: in debriefings, every participant described the randomly timed prompts and ten minute response window as stressful and intrusive. This raises concerns that the measurement tool may have interfered with the very outcomes it aimed to track, a phenomenon previously observed in EMA research (Shiffman et al., 2008). Second, the heavy EMA burden made recruitment difficult. The original plan to recruit students with subclinical stress and low mentalization via prescreening failed to recruit any participants. The study therefore switched to convenience sampling of young adults. As a result, individuals who might have benefited most were likely not included in the sample. Third, technical constraints within the TIIM app required replacing planned multi-item scales with single-item EMA measures and introduced malfunctions, such as prompts that could not be opened and completed entries that were not saved. These technical issues introduced gaps in the data, likely inflating stress and negatively impacting mentalization and self-efficacy. Fourth, the small

sample size and the low baseline stress of some participants may have limited observable change. Additionally, momentary scores were likely influenced by uncontrolled short-term life events. Finally, although adherence to the expressive writing task itself was high, EMA compliance still varied significantly between participants.

Building on these lessons, future studies should focus on four primary areas. First, future EMA protocols could extend response windows, reduce prompt frequency, and lengthen the study duration. This would reduce intrusiveness, increase compliance, and minimize the impact of short-term life events on participants' momentary states (Kunchay et al., 2024; Shiffman et al., 2008). Using wearable-based EMA tools, such as smartwatches, might also help reduce burden and enhance data quality (Stone et al., 2025). Second, recruitment strategies should explicitly target individuals who are most likely to benefit from expressive writing interventions, specifically those with elevated stress, low mentalization, and low self-efficacy. Third, future research should prioritize the use of robust multi-item measures and carefully tested technical platforms to ensure high-quality and reliable data. Finally, future interventions could be improved by providing clearer structure, explicit guidance, and longer duration, potentially allowing initial distress to evolve into meaningful long-term benefits, as suggested by prior expressive writing research (Frattaroli, 2006). Furthermore, grouping participants based on their level of engagement could clarify who benefits most from the intervention (Niles et al., 2013; Rude et al., 2023). These differences also point to the need for clear explanation and proper guidance when introducing expressive writing. Without a well-structured framework, participants may disengage or worse, engage in a way that amplifies distress rather than alleviates it.

Conclusion

This study used a within-subject AB design with EMA to examine whether a one-week, unguided mentalization-based expressive writing intervention could reduce stress and improve mentalization and self-efficacy in young adults. Results showed no improvements immediately after writing sessions and, unexpectedly, revealed significant declines in mentalization and self-efficacy across the intervention week, with stress remaining unchanged. Some individual variability was observed, underscoring the value of person-level analysis in capturing effects masked at the group level. These findings align with the "distress paradox," which suggests that engaging with emotionally difficult material may cause short-term discomfort. In this context, that discomfort may have been intensified by cognitive mechanisms such as

hypermentalization and rumination, as well as the intrusiveness of the EMA protocol. Technical malfunctions in the data collection app may have further undermined participant experience and data quality. Consistent with prior research, these results suggest that the effectiveness of expressive writing depends on participant engagement and the presence of appropriate structure or guidance. Without these, such interventions may not only fail to help but could potentially be counterproductive. Future studies should explore longer, more guided versions of the intervention, implement less intrusive and more reliable EMA methods, and identify for whom, and under what conditions, mentalization-based writing may be most effective.

References

Baars, M., Khare, S., & Ridderstap, L. (2022). Exploring Students' Use of a Mobile Application to Support Their Self-Regulated Learning Processes. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.793002

Baikie, K. A., & Wilhelm, K. (2005). Emotional and physical health benefits of expressive writing. *Advances in Psychiatric Treatment*, *11*(5), 338–346. https://doi.org/10.1192/apt.11.5.338

Ballespí, S., Vives, J., Sharp, C., Tobar, A., & Barrantes-Vidal, N. (2019). Hypermentalizing in Social Anxiety: Evidence for a Context-Dependent Relationship. *Frontiers in Psychology*, *10*. https://doi.org/10.3389/fpsyg.2019.01501

Cameron, G., Mulvenna, M., Ennis, E., O'Neill, S., Bond, R., Cameron, D., & Bunting, A. (2024). Effectiveness of digital mental health interventions in the workplace: An umbrella review of systematic reviews (Preprint). *JMIR Mental Health*, *12*, e67785. https://doi.org/10.2196/67785

Chelouche-Dwek, G., & Fonagy, P. (2024). Mentalization-based interventions in schools for enhancing socio-emotional competencies and positive behaviour: a systematic review. *European Child Adolescent Psychiatry*. https://doi.org/10.1007/s00787-024-02578-5

Cohen, S., & Williamson, G. (1988). Perceived stress in a probability sample of the united states. In S. Spacapan & S. Oskamp (Eds.), *The social psychology of health* (pp. 31–67). Sage.

Edge, D., Watkins, E. R., Limond, J., & Mugadza, J. (2023). The efficacy of self-guided internet and mobile-based interventions for preventing anxiety and depression – A systematic review and meta-analysis. *Behaviour Research and Therapy*, *164*, 104292. https://doi.org/10.1016/j.brat.2023.104292

Field, A. (2016). *Exploring Data: The Beast of Bias* (tech. rep.). https://discoveringstatistics.com/repository/exploringdata.pdf

Fisher, A. J., Medaglia, J. D., & Jeronimus, B. F. (2018). Lack of group-to-individual generalizability is a threat to human subjects research. *Proceedings of the National Academy of Sciences*, *115*(27), E6106–E6115. https://doi.org/10.1073/pnas.1711978115

Fleisher, C. (2018). Book forum. *Journal of the American Academy of Child Adolescent Psychiatry*, *57*(4), 291–292. https://doi.org/10.1016/j.jaac.2018.02.004

Frattaroli, J. (2006). Experimental disclosure and its moderators: A meta-analysis. *Psychological Bulletin*, *132*(6), 823–865. https://doi.org/10.1037/0033-2909.132.6.823

Guo, L. (2022). The delayed, durable effect of expressive writing on depression, anxiety and stress: A meta-analytic review of studies with long-term follow-ups. *British Journal of Clinical Psychology*, *62*(1), 272–297. https://doi.org/10.1111/bjc.12408

Hausberg, M. C., Schulz, H., Piegler, T., Happach, C. G., Klöpper, M., Brütt, A. L., Sammet, I., & Andreas, S. (2012). Is a self-rated instrument appropriate to assess mentalization in patients with mental disorders? development and first validation of the mentalization questionnaire (mzq). *Psychotherapy Research*, *22*(6), 699–709. https://doi.org/10.1080/10503307.2012.709325

Hoult, L. M., Wetherell, M. A., Edginton, T., & Smith, M. A. (2025). Positive expressive writing interventions, subjective health and wellbeing in non-clinical populations: A systematic review. *PLoS ONE*, *20*(5), e0308928. https://doi.org/10.1371/journal.pone.0308928

Keles, B., McCrae, N., & Grealish, A. (2019). A systematic review: the influence of social media on depression, anxiety and psychological distress in adolescents. *International Journal of Adolescence and Youth*, *25*(1), 79–93. https://doi.org/10.1080/02673843.2019.1590851

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime Prevalence and Age-of-Onset Distributions of DSM-IV Disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, *62*(6), 593. https://doi.org/10.1001/archpsyc.62.6.593

Konigorski, S., Ried-Larsen, M., & Schmid, C. H. (2024). Digital n-of-1 trials and their application in experimental physiology [Preprint]. *Experimental Physiology*. https://arxiv.org/pdf/2412.15076

Kunchay, S., Linden-Carmichael, A. N., & Abdullah, S. (2024). Using a smartwatch app to understand young adult substance use: Mixed methods feasibility study. *JMIR Human Factors*, *11*, e50795. https://doi.org/10.2196/50795

Liu, X., Li, Y., & Cao, X. (2024). Bidirectional reduction effects of perceived stress and general self-efficacy among college students: a cross-lagged study. *Humanities and Social Sciences Communications*, *11*(1). https://doi.org/10.1057/s41599-024-02785-0

Lukenda, K., Sülzenbrück, S., & Sutter, C. (2024). Expressive writing as a practice against work stress: An experimental study. *Journal of Workplace Behavioral Health*, 1–24. https://doi.org/10.1080/15555240.2024.2366220

Luszczynska, A., Scholz, U., & Schwarzer, R. (2005). The general self-efficacy scale: Multicultural validation studies. *The Journal of Psychology*, *139*(5), 439–457. https://doi.org/10.3200/JRLP.139.5.439-457

Luyten, P., Campbell, C., Allison, E., & Fonagy, P. (2020). The Mentalizing Approach to Psychopathology: State of the Art and Future Directions. *Annual Review of Clinical Psychology*, *16*(1), 297–325. https://doi.org/10.1146/annurev-clinpsy-071919-015355

Luyten, P., & Fonagy, P. (2015). The neurobiology of mentalizing. *Personality Disorders Theory Research and Treatment*, *6*(4), 366–379. https://doi.org/10.1037/per0000117

Lyubomirsky, S., & Nolen-Hoeksema, S. (1995). Effects of self-focused rumination on negative thinking and interpersonal problem solving. *Journal of Personality and Social Psychology*, *69*(1), 176–190. https://doi.org/10.1037/0022-3514.69.1.176

Matud, M., Díaz, A., Bethencourt, J., & Ibáñez, I. (2020). Stress and Psychological Distress in Emerging Adulthood: A Gender analysis. *Journal of Clinical Medicine*, *9*(9), 2859. https://doi.org/10.3390/jcm9092859

McDonald, S., Quinn, F., Vieira, R., O'Brien, N., White, M., Johnston, D. W., & Sniehotta, F. F. (2017). The state of the art and future opportunities for using longitudinal n-of-1 methods in health behaviour research: a systematic literature overview. *Health Psychology Review*, *11*(4), 307–323. https://doi.org/10.1080/17437199.2017.1316672

Niles, A. N., Haltom, K. E. B., Mulvenna, C. M., Lieberman, M. D., & Stanton, A. L. (2013). Randomized controlled trial of expressive writing for psychological and physical health: the moderating role of emotional expressivity. *Anxiety Stress Coping*, *27*(1), 1–17. https://doi.org/10.1080/10615806.2013.802308

Pennebaker, J. W. (2016, July). *Opening Up by Writing It Down, Third Edition: How Expressive Writing Improves Health and Eases Emotional Pain*. https://www.amazon.com/Opening-Writing-Down-Third-Expressive-ebook/dp/B01GK5817W

Prep, S. W. T. (2023, July). Erik Erikson39;s Stages of Psychosocial Development. https://socialworktestprep.com/blog/2023/july/27/erik-erikson-s-stages-of-psychosocial-development/?srsltid=AfmBOop9KNsEB67a5Dyw6PnpXVfpRk282aOS2yrPWT4RSCGIxPMc0Y2_

Reinhold, M., Bürkner, P.-C., & Holling, H. (2018). Effects of expressive writing on depressive symptoms-A meta-analysis. *Clinical Psychology Science and Practice*, *25*(1), e12224. https://doi.org/10.1111/cpsp.12224

Ringeisen, T., Lichtenfeld, S., Becker, S., & Minkley, N. (2018). Stress experience and performance during an oral exam: the role of self-efficacy, threat appraisals, anxiety, and cortisol. *Anxiety Stress Coping*, *32*(1), 50–66. https://doi.org/10.1080/10615806.2018.1528528

Rude, S. S., Lantrip, C., Aguirre, V. A., & Schraegle, W. A. (2023). Chasing elusive expressive writing effects: emotion-acceptance instructions and writer engagement improve outcomes. *Frontiers in Psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1192595

Sharma, P. (2023). Self-Efficacy and its Role in Coping with Stress: A Review of Recent Literature. *Journal for ReAttach Therapy and Developmental Diversities*, 1047–1054. https://doi.org/10.53555/jrtdd.v6i8s.3399

Sharp, C., Ha, C., Carbone, C., Kim, S., Perry, K., Williams, L., & Fonagy, P. (2013). Hypermentalizing in Adolescent Inpatients: Treatment Effects and Association With Borderline Traits. *Journal of Personality Disorders*, *27*(1), 3–18. https://doi.org/10.1521/pedi.2013.27.1.3

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annual review of clinical psychology*, *4*, 1–32. https://doi.org/10.1146/annurev.clinpsy.3.022806.091415

Smyth, J. M. (1998). Written emotional expression: Effect sizes, outcome types, and moderating variables. *Journal of Consulting and Clinical Psychology*, *66*(1), 174–184. https://doi.org/10.1037/0022-006x.66.1.174

Solervicens, P., Kneer, J., Cerda, K., Geldres, A., & Guzmán, T. (2024). Mediating role of mentalization in depressive symptoms among college university students. *Medical Research Archives*, *12*(6). https://doi.org/10.18103/mra.v12i6.5479

Stone, C., Adams, S., Wootton, R. E., Skinner, A., & colleagues. (2025). Smartwatch-based ecological momentary assessment for high-temporal-density longitudinal measurement of alcohol use

("alcowatch"): Feasibility evaluation. *JMIR Formative Research*, *9*(1), e63184. https://doi.org/10.2196/63184

Takano, K., & Tanno, Y. (2009). Self-rumination, self-reflection, and depression: Self-rumination counteracts the adaptive effect of self-reflection. *Behaviour Research and Therapy*, *47*(3), 260–264. https://doi.org/10.1016/j.brat.2008.12.008

Travagin, G., Margola, D., & Revenson, T. A. (2015). How effective are expressive writing interventions for adolescents? A meta-analytic review. *Clinical Psychology Review*, *36*, 42–55. https://doi.org/10.1016/j.cpr.2015.01.003

Appendix A

Perceived stress scale (PSS-10)

Figure A1

PSS-10

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

In the last month, how often have you...

	Never	Almost never	Sometimes	Fairly Often	Very Often
Been upset because of something that happened Unexpectedly?	○	○	○	○	○
Felt that you were unable to control the important things in your life?	○	○	○	○	○
Felt nervous and "stressed"?	○	○	○	○	○
Felt confident about your ability to handle your personal problems?	○	○	○	○	○
Felt that things were going your way?	○	○	○	○	○
Found that you could not cope with all the things that you had to do?	○	○	○	○	○
Been able to control irritations in your life?	○	○	○	○	○
Felt that you were on top of things?	○	○	○	○	○
Been angered because of things that were outside of your control?	○	○	○	○	○
Felt difficulties were piling up so high that you could not overcome them?	○	○	○	○	○

Appendix B

Mentalization questionnaire (MZQ)

Figure B1

MZQ

Below you will find several statements concerning your ability to perceive your own feelings and the feelings of others. We would like you to rate your agreement with these statements. Please respond to each statement on the scale from 'I disagree' to 'I agree'.

	I disagree	I partly disagree	undecided	I partly agree	I agree
1. If I expect to be criticized or offended, my fear increases more and more.	☐1	☐2	☐3	☐4	☐5
2. Explanations of others are of little assistance in understanding my feelings.	☐1	☐2	☐3	☐4	☐5
3. Sometimes feelings are dangerous for me.	☐1	☐2	☐3	☐4	☐5
4. I can only believe that someone really likes me a lot if I have enough realistic proof for it (e.g., a date, a gift or a hug).	☐1	☐2	☐3	☐4	☐5
5. Most of the time it is better not to feel anything.	☐1	☐2	☐3	☐4	☐5
6. Often I can't control my feelings.	☐1	☐2	☐3	☐4	☐5
7. It's difficult for me to believe that relationships can change.	☐1	☐2	☐3	☐4	☐5
8. I tend to ignore feelings of physical tension or of discomfort until they compel my whole attention.	☐1	☐2	☐3	☐4	☐5
9. Talking about feelings would mean that they become more and more powerful.	☐1	☐2	☐3	☐4	☐5
10. Sometimes I only become aware of my feelings in retrospect.	☐1	☐2	☐3	☐4	☐5
11. Frequently it's difficult for me to perceive my feelings at their full intensity.	☐1	☐2	☐3	☐4	☐5
12. Often I feel threatened by the idea that someone could criticize or offend me.	☐1	☐2	☐3	☐4	☐5
13. If someone yawns in my presence, that's a reliable sign that he is bored in my company.	☐1	☐2	☐3	☐4	☐5
14. Most of the time I don't feel like talking about my thoughts and feelings with others.	☐1	☐2	☐3	☐4	☐5
15. Often I don't even know what is happening inside of me.	☐1	☐2	☐3	☐4	☐5

Appendix C

General Self-Efficacy Scale (GSE)

Figure C1

GSE

HONEY LAKE CLINIC

General Self-Efficacy Scale (GSE)

		Not at all true	Hardly true	Moderately true	Exactly true
1	I can always manage to solve difficult problems if I try hard enough	☐	☐	☐	☐
2	If someone opposes me, I can find the means and ways to get what I want.	☐	☐	☐	☐
3	It is easy for me to stick to my aims and accomplish my goals.	☐	☐	☐	☐
4	I am confident that I could deal efficiently with unexpected events.	☐	☐	☐	☐
5	Thanks to my resourcefulness, I know how to handle unforeseen situations.	☐	☐	☐	☐
6	I can solve most problems if I invest the necessary effort.	☐	☐	☐	☐
7	I can remain calm when facing difficulties because I can rely on my coping abilities.	☐	☐	☐	☐
8	When I am confronted with a problem, I can usually find several solutions.	☐	☐	☐	☐
9	If I am in trouble, I can usually think of a solution	☐	☐	☐	☐
10	I can usually handle whatever comes my way.	☐	☐	☐	☐

Appendix D

Ecological momentary assessment questionaire (EMA)

Participants responded to the following items via the TIIM app. Unless stated otherwise, all items used a slider scale ranging from **1 (Not at all)** to **100 (Very much)**.

1. *At this moment my positive feelings are.*

   Response format: Slider (1–100)

2. *At this moment my negative feelings are.*

   Response format: Slider (1–100)

3. *At this moment I feel stressed.*

   Response format: Slider (1–100)

4. *At this moment how many other people are you with?*

   Response format: Dropdown with the following options:

   `0, 1, 2, 3, 4, 5, 6, More than 6`

5. *Who are you with? (You can select more than one answer.)*

   Response format: Multi-select dropdown with the following options:

   `Family, Partner, Friend(s), Colleague(s)/Classmate(s), Stranger(s)`

6. *At this moment, I like this company.*

   Response format: Slider (1–100)

7. *At this moment, I like being alone.*

   Response format: Slider (1–100)

8. *At this moment what are you doing?*

   Response format: Dropdown with the following options:

   `Eating, Working/Studying, Physical activity, Household tasks, Resting, Using social media, Watching a movie/series, Hobbies, Hanging out with friends, Personal care, On my way to somewhere, Something else`

9. *How much are you enjoying this?*

   Response format: Slider (1–100)

10. *At this moment where are you?*

    Response format: Dropdown with the following options:

    `At home, At work/school, Public place, Traveling, Somewhere else outdoors, Somewhere else indoors`

11. *Think about the most important situation (event, thought or feeling) since the last survey. This was.*

    Response format: Slider (1–100)

12. *How stressful was this situation?*

    Response format: Slider (1–100)

13. *At this moment I understand how I feel.*

    Response format: Slider (1–100)

14. *At this moment I have clear thoughts.*

    Response format: Slider (1–100)

15. *I am confident that I can deal with upcoming tasks*

    Response format: Slider (1–100)

16. *At this moment I am confident that I can deal with upcoming tasks.*

    Response format: Slider (1–100)

Appendix E

Mentalization through expressive writing

General Instructions (Repeated Daily):

Before you begin:

Find a quiet space where you won't be disturbed. Sit comfortably, take a deep breath, and give yourself permission to be fully present. Try to write continuously for 5–10 minutes, without worrying about grammar, spelling, or structure. This is a private space for reflection—focus on honesty and depth, not perfection.

Day 1: Stressful Moment Reflection

Recall a recent moment in the past week when you felt particularly stressed or overwhelmed. It could have been related to an academic deadline, a social conflict, or a personal challenge.

- Describe the situation in detail:
  - What was happening?
  - What were you thinking and feeling at the time?
  - Can you identify why you felt that way, and what the experience meant to you?

Day 2: Perspective Taking

Think back to a recent conversation or situation where someone you know appeared upset, anxious, or emotionally unsettled. This could be a friend, classmate, roommate, or even someone you briefly encountered.

- Describe what you observed—what made you think they were feeling that way?
- Try to imagine what might have been going through their mind.
- What emotions do you think they were experiencing, and why?

Day 3: Calming or Grounding Experience

Reflect on a recent moment—either planned or spontaneous—when you felt calm, grounded, or uplifted. This could be a walk, a quiet evening, a conversation, or even a brief pause between tasks.

- Describe the details of the situation: Where were you? What were the sights, sounds, smells?
- How did your environment influence your emotional state?
- What does this tell you about the kinds of settings or experiences that help you recharge?

Day 4: Emotional Regulation

Think about a situation in the past week where you struggled to manage your emotions. Maybe you felt angry, anxious, or discouraged, and it was hard to stay in control.

- What triggered the emotion, and what did you do in response?
- What made it especially difficult to regulate how you felt?
- Looking back, what might help you cope better if something similar happens again?

Day 5: Impact of Your Communication

Recall a recent interaction with someone—big or small—that seemed to affect them emotionally. It might have been something you said, your tone, or even nonverbal communication.

- Describe what happened: What did you notice in their response?
- What do you think your words or behavior meant to them in that moment?
- Did your intention match the outcome?

Day 6: Emotional Clarity and Awareness

Think of a time recently when you experienced strong or mixed emotions. This could have been a joyful moment, a disappointment, or a time of inner conflict.

- How aware were you of your emotional state while it was happening?

- Were your feelings clear and recognizable, or confusing and difficult to name?
- What helped or hindered your ability to make sense of your emotions?

Day 7: Reflection on Emotional Change

Looking back over the past week, consider whether anything has changed in how you understand your own or other people's emotions.

- Can you think of a moment where you felt more attuned to your feelings, or better able to read someone else's mood or needs?
- If you haven't noticed any change, try to explore why that might be—has anything blocked your emotional awareness or reflection?

Appendix F

Participant intake script

Estimated Duration: 20 minutes

1. Welcome and Introduction

- Welcome the participant and introduce yourself.
- Explain the purpose of the meeting.
- Mention that the session includes an explanation of the study, TIIM app setup, and a test run.

2. Study Purpose

- Explain the goal: testing whether structured writing (mentalization-based) helps reduce stress.

3. What is Mentalization? Why Expressive Writing?

- Explain that mentalization is the ability to understand your own and others' thoughts and emotions.
- Mention how this skill helps with emotional regulation and stress management.
- Explain expressive writing using Pennebaker's approach: encourage them to enter a 'flow' state and write freely without worrying about grammar or spelling.

4. What is Ecological Momentary Assessment (EMA)

- Explain EMA as a method of collecting real-time data through short surveys during daily life.
- Emphasize that this method provides a more accurate picture than one-time questionnaires.

5. Using the TIIM App

- Help the participant download and install the TIIM app.
- Log in using the participant ID.
- Show how to respond to a survey notification.
- Test a sample survey together.

- Ensure that notification settings are enabled.
- Explain how to check if a survey was missed.

6. Control Condition vs. Intervention Condition

- Explain that participants may be randomly assigned to either a mentalization-writing group or a control group.
- Clarify that all participants will complete the same daily EMA surveys.

7. Timeline and Overview

- Explain the full participation timeline:
  - Day 1: Intake + baseline questionnaire
  - Days 1–14: Daily EMA surveys via TIIM (5 times per day)
  - Days 8–14: Daily mentalization writing task (intervention group only)
  - Day 14: Final questionnaire and outtake

8. Confidentiality and Questions

- Confirm confidentiality and the right to withdraw at any time.
- Ask the participant if they have any questions.
- Provide your contact details and ensure they have your email for follow-up questions.

Appendix G

Assumption checks

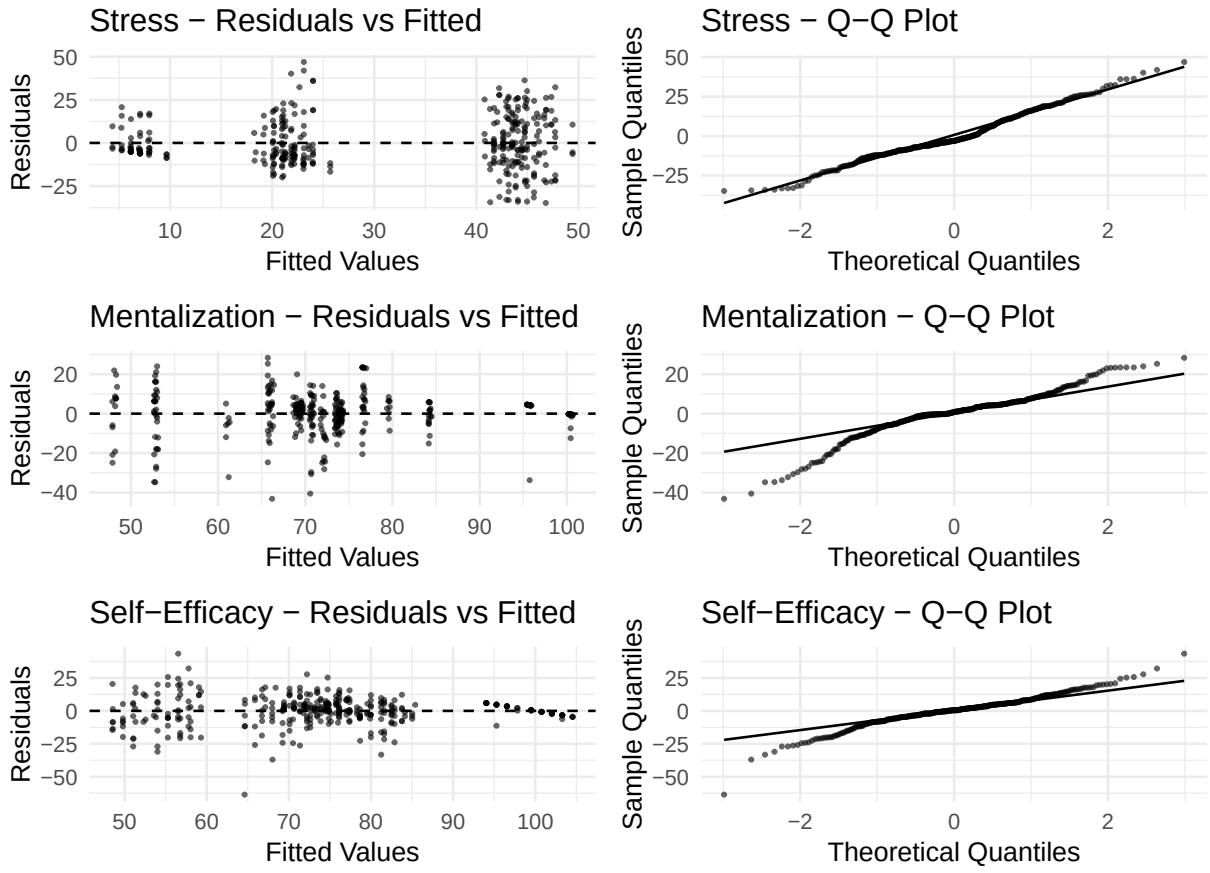

Figure G1

Visual summary of fixed effects with confidence intervals from linear mixed-effects models.

Appendix H

Sensitivity Analysis Results

Table H1

Fixed-effect estimates (b) and t-values: full sample vs. sensitivity sample

Outcome	**Predictor**	**All participants (N = 8)**		**Sensitivity (N = 6)**	
		b	*t*	*b*	*t*
Stress	Post-Writing	1.72	0.58	1.14	0.36
	Treatment	–0.03	–0.02	1.26	0.66
	Prompt	–0.90	–1.32	–0.88	–1.24
Self-Efficacy	Post-Writing	0.03	0.01	0.48	0.21
	Treatment	–5.48	–4.09	–6.87	–4.99
	Prompt	1.26	2.45	1.38	2.67
Mentalization	Post-Writing	–0.20	–0.09	0.01	0.01
	Treatment	–4.59	–3.57	–4.16	–3.06
	Prompt	0.11	0.22	0.27	0.53

Appendix I

AI Usage

During the preparation of this work, the author(s) used [ChatGPT 4.0] to help with the grammar and structure of the text and with helping for coding RStudio. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the work.