

Improving Implicit Self-esteem via a Targeted Mobile Cognitive Bias Modification

Intervention

Evan Sowder

S2908409

Department of Behaviour Management and Social Sciences, University of Twente

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First Supervisor: Dr. Marcel Pieterse

Second Supervisor: Peter ten Klooster

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Abstract

Background: Implicit self-esteem (ISE), the automatic and unconscious component of self-worth, has been recognized as a key factor in mental health and well-being. Cognitive bias modification (CBM) interventions have shown potential for enhancing implicit attitudes through targeted attention training and belief modification. Improving implicit self-esteem may be particularly beneficial as an add-on treatment for individuals with depression and anxiety where self-esteem is a key vulnerability factor and treatment target. The current pilot pre-post study aims to explore the efficacy of a novel CBM intervention for improving implicit self-esteem in adults aged 18+. Furthermore, its impact on explicit self-esteem, depression, and anxiety will be evaluated.

Methods: 18 participants were used for data analysis (12 females, mean age 25 years). The participants completed psychometric scales measuring explicit self-esteem, depression, anxiety, and an Implicit Association Test (IAT) involving a matching game which was used to measure implicit self-esteem. Next, participants were asked to participate in a 3-day CBM intervention game twice a day which involved matching terms using implicit association and CBM built in the TIIM (Twente Intervention and Interaction Machine) app on their mobile phone. Afterwards, participants were asked to complete the same psychometric scales and the IAT again.

Results: A statistically significant increase in implicit self-esteem scores from pretest ($Mdn = 0.41$, $IQR = 0.48$) to posttest ($Mdn = 0.62$, $IQR = 0.39$; $V = 125$, $p = .045$) was found. However, changes in ISE were not significantly correlated with changes in depression ($\rho = .38$, $S = 597.11$, $p = .116$) or anxiety ($\rho = .18$, $S = 794.55$, $p = .475$). Furthermore, The results indicated a non-significant, weak positive correlation between Implicit self-esteem and explicit self-esteem ($\rho = .03$, $p = .898$).

Conclusion: This pilot study examined the effects of a CBM intervention on implicit self-esteem (ISE) and its potential links to well-being, explicit self-esteem (ESE), and symptoms of depression and anxiety. The intervention led to a significant increase in ISE, though associations between changes in ISE and changes in depression, anxiety, and ESE were not statistically significant. The increase in ISE suggests further research is needed, as the study's limited sample size may have impeded the detection of significant relationships. Overall, the findings highlight the need for future studies with larger samples and more robust methodologies to better understand the intervention's impact on psychological well-being.

1. Introduction

1.1 The Detrimental Effects of Low Self-esteem

Low self-esteem is characterized by a low sense of self-worth and lack of confidence in one's abilities. Self-esteem is a concept which reflects an individual's appraisal of their own worth or value (Wiechert, et. al., 2023). Research shows that low self-esteem and depression are strongly related, but the temporal nature of this relationship is a source of controversy (Sowislo & Orth, 2013). A meta-analysis by Sowislo and Orth (2013) found that the effect of self-esteem on depression was significantly stronger than the effect of depression on self-esteem. In contrast, the reciprocal effects between low self-esteem and anxiety were relatively balanced: Self-esteem predicted anxiety and anxiety predicted self-esteem. Furthermore, moderation analysis showed that these relations were not significantly affected by age and gender. The absence of moderator effects across demographic variables suggests a robust and generalizable phenomenon and implies that the observed relationships may be relatively universal within the studied population, emphasizing the potential for broadly applicable interventions.

Due to the pivotal role self-esteem plays in both the development of depression and anxiety, interventions targeting and changing it are justified. Especially if the hypothesized causality of the vulnerability effect of low self-esteem on depression is further supported, interventions aimed at increasing self-esteem might be useful in reducing the risk of depression (Sowislo & Orth, 2013). Additionally, low self-esteem's impact extends beyond mental health, significantly influencing various life domains. For instance, research has linked low self-esteem to detrimental health-related behaviors. Individuals with low self-esteem may be more susceptible to substance abuse (Ersöğütçü & Karakaş, 2016), unhealthy dietary habits (Martyn-Nemeth, et. al., 2009), and lower levels of physical activity (Bobbio, 2009). These behaviors can further exacerbate mental health issues and contribute to a decline in overall well-being.

Moreover, academic achievement is also vulnerable to the effects of low self-esteem. Studies have shown a correlation between low self-esteem and lower academic performance (Arshad, Zaidi, & Mahmood, 2015). Students with low self-esteem may doubt their abilities, set lower goals, and be more sensitive to criticism, hindering their academic progress. In conclusion, self-esteem influences a wide array of mental health problems in addition to a wide

array of other poor outcomes that affect quality of life, wellbeing, physical health and overall achievement.

1.2 Self-Esteem and Self-Esteem Interventions

In order to develop interventions involving self-esteem, first, the time varying nature of self-esteem must be discussed along with past interventions. Recent longitudinal studies have provided new insights into the development of self-esteem and its long-term implications. The evidence suggests that self-esteem typically follows a distinct trajectory, increasing from adolescence to middle adulthood, peaking around age 50-60, and then declining into old age. This trajectory appears consistent across different age cohorts (Orth et al., 2009). Importantly, self-esteem is often considered a relatively stable personality trait, with individuals maintaining relatively high or low self-esteem over decades (Orth et al., 2009).

However, this does not mean that self-esteem is immutable (Robins & Trzesniewski, 2014). Experimental studies have shown that certain cognitive and affective processes can lead to short-term changes in self-evaluation, though the long-term impact of such interventions remains less clear (Robins & Trzesniewski, 2014). Some studies have investigated whether it is possible to change self-esteem in the short term and long term. In terms of long-term change one study found that, much like other personality traits, self-esteem can change over time (Chung, Robins et al., 2014). Nonetheless some studies have also found that self-esteem is responsive to negative life events. Research suggests that individuals with low explicit self-esteem experience a decline in their implicit self-esteem after negative life events. Conversely, those with high explicit self-esteem and a clear self-concept maintain stable implicit self-esteem even when facing adversity (Park et al., 2011). This difference highlights the potential for short-term fluctuations in implicit self-esteem based on both pre-existing self-views and recent experiences. This is because people with high explicit self-esteem tend to have positive, well-articulated beliefs about themselves that remain stable in response to negative events. People with low explicit self-esteem tend to be more neutral and uncertain about their beliefs about the self, which are influenced by recent negative experiences (Mandy Grumm, Nestler, von Collani, 2006). This shows that self-esteem can be changed in the short term due to negative life events, however it remains unclear if self-esteem can be positively influenced via short term targeted interventions. Furthermore, some types of self-esteem may be more susceptible to change via certain targeted interventions. For example, implicit self-esteem may be changeable via interventions that target implicit biases.

1.3 Implicit Self-Esteem, Explicit Self-Esteem, and the Dual Process Model

According to the dual process model there are two distinct types of self-esteem that need to be distinguished. The different types of self-esteem occur both as the result of conscious and unconscious cognitions. Explicit self-esteem (ESE) is characterized by conscious evaluations of the self. These evaluations often occur within the individual's conscious awareness and can affect our deliberate decision-making and self-perception. Implicit self-esteem (ISE) is the part of self-esteem that is often hidden from view. It is internal and can cause unconscious cognitive biases. ISE is often characterized as evaluations of the self that occur outside awareness and refers to unconscious or automatic feelings and evaluations we have about ourselves. These are formed through our experiences, social interactions, and cultural influences (Tafarodi et al., 2006). As opposed to ESE, which can be assessed by self-reported measurement scales, ISE is typically measured using indirect measures, such as the implicit association test, which assesses the strength of automatic associations between self and positive or negative concepts (Wilson & Scior, 2013).

The dual process model proposes that implicit and explicit self-esteem can interact and influence each other. For example, individuals with high explicit self-esteem may also have high implicit self-esteem, resulting in a strong overall sense of self-worth. On the other hand, someone with high explicit self-esteem but low implicit self-esteem may experience conflicts within themselves, as their conscious evaluation of self does not align with their unconscious feelings and beliefs. This model also suggests that implicit and explicit self-esteem may have differential effects on our behavior. For example, individuals with high explicit self-esteem may be more likely to engage in positive self-promotion and assertiveness, while those with high implicit self-esteem may be more prone to automatic self-protection and avoidance of threatening situations (McNulty, 2010).

1.4 Implicit self-esteem

Implicit self-esteem refers to internal unconscious evaluations about the self and represents a more intuitive and automatic way of processing information about the self. Most prior research focused on explicit self-esteem and conscious evaluations one makes about the self. However, the importance of implicit cognitions and self-esteem and its role in various pathologies and personality disorders has become increasingly recognized. Implicit cognitions are important to determine the cause of various pathologies and play key roles in determining therapies and relapse effects.

Implicit self-esteem is typically tested via computer association tests. Both ISE and ESE have an effect on mental health. It is theorized that ISE has a stronger effect on internalizing disorders, however the evidence is unclear. One study found significantly lower implicit self-

esteem in current depressive patients than in the healthy control group, and no significant differences in implicit self-esteem between remitted recurrent depressive patients and healthy controls (Risch et al., 2010). Furthermore, remitted depressed patients with three or more depressive episodes showed a significantly lower implicit self-esteem than those with less than three depressive episodes (Risch et al., 2010). Another study testing ISE and its effects on anxiety showed that socially anxious patients were more likely to have lower self-esteem and that automatic associations relating to social cues were more dysfunctional than in the control groups.

This is particularly relevant given evidence suggesting a complex relationship between implicit self-esteem, gender, and mental health. For instance, Glashouwer et al. (2013) found that low ISE correlated with higher symptom severity in men, but not women. While the reasons for this gender difference remain unclear, it highlights the potential importance of addressing implicit processes, especially as some researchers argue that ISE may represent a more authentic "actual self". Understanding these nuances is crucial for developing tailored and effective interventions. This is where Cognitive Bias Modification (CBM) comes into play because, unlike interventions that address conscious beliefs, CBM training can effectively target the unconscious biases driving implicit self-esteem.

1.5 Cognitive Bias Modification (CBM) and Implicit Association Tests

CBM is a form of training that aims to change implicit associations and internal biases within its users. It does this by presenting the user with various pictures or words. Some cues the user must pull towards them, while other cues the user must push away. CBM has been used successfully in the past to increase positive orientation and to decrease alcohol related implicit biases (Orth et al., 2009). In recent years, there has been growing interest in the potential of Cognitive Bias Modification as a therapeutic tool for addressing depression and anxiety (Devi et al., 2021). CBM aims to modify the cognitive biases that contribute to the maintenance of these disorders, with the goal of promoting more adaptive patterns of thinking and behavior (Söchting, 2014).

CBM interventions typically involve computer-based tasks that target specific cognitive biases, such as attention bias, interpretation bias, or memory bias. These tasks can include dot-probe tasks, where participants are presented with pairs of stimuli and are required to respond to the location of a probe that appears on the screen, and implicit association tasks, where participants are asked to associate specific stimuli with positive or negative words. The intervention for this study will focus on IAT-based memory bias modification (Beard, 2015; Nosek et al., 2011) (Forscher et al., 2019).

Furthermore, the use of CBM interventions as an adjunct to traditional therapies, such as cognitive behavioral therapy (CBT), has also been explored. The combination of CBM with CBT has shown potential for enhancing treatment outcomes and reducing the risk of relapse (Cristea et al., 2015). However, the majority of research on CBM in the mental health field has focused on depression and anxiety, rather than self-esteem (Hertel & Mathews, 2011). Research in this area has shown promising results, with some studies demonstrating that CBM interventions can lead to reductions in symptoms of depression and anxiety (Beard & Amir, 2014). To date, however, there is limited research specifically examining the use of CBM in addressing self-esteem issues.

As CBM can be further changed and adapted for different purposes, it is important to delve into the underlying mechanisms of action and to explore the potential for personalized CBM interventions tailored to individuals and select target groups. Other studies have tried to raise self-esteem using CBM techniques. One similar study found that pairing self-affirming words with smiling faces utilizing a computer game demonstrated the benefits of classical conditioning and learning on influencing implicit self-esteem. However, this study did not use push or pull techniques because computers and smartphones were not yet readily and widely available (Baccus, Baldwin, & Packer, 2004). In the present study the use of evaluative conditioning and the use of push and pull techniques via verbal stimuli pertaining to the user adds in a new element. *Push-pull* techniques are a persuasive communication strategy that employs both positive reinforcement ("pulling" towards desirable options) and negative framing ("pushing" away from undesirable ones) (Wiers, 2015). Evaluative conditioning is a type of learning in which the valence (i.e., the positive or negative value) of a stimulus is transferred to a neutral stimulus by repeatedly pairing the two stimuli together. Essentially, something we do not have strong feelings about (the neutral stimulus) becomes associated with something we like or dislike (the valenced stimulus), leading us to develop a similar attitude towards the previously neutral thing (De Houwer, Thomas, & Baeyens, 2001).

Another study found that evaluative conditioning was effective in raising implicit self-esteem but not explicit self-esteem. However, if participants were asked to think about their feelings prior to self-report, some of the effects of evaluative conditioning appeared to spill over to explicit self-esteem. By influencing the process of self-evaluation implicit self-esteem was raised. For example, Grumm, Nestler, and von Collani (2009) explored the distinct effects of evaluative conditioning and self-focused thinking on implicit and explicit self-esteem. Their findings revealed that while evaluative conditioning successfully shifted implicit self-esteem without impacting explicit beliefs, prompting participants to think about themselves led to

changes in explicit self-esteem but not implicit associations. Intriguingly, a third experiment demonstrated that the influence of evaluative conditioning could extend to the explicit level when participants were instructed to focus on their feelings before making self-judgments (Grumm, Nestler, & von Collani, 2009). The CBM training aims to utilize a similar process via word sorting and addressing implicit biases to influence self-evaluation via the use of evaluative conditioning.

1.6 The TIIM App and Its Applications

The TIIM app is an app that was designed by the University of Twente to design mobile psychological interventions (Van 't Klooster et al., 2024). For the purpose of this study, it incorporated an IAT matching game to address cognitive biases via evaluative conditioning and secondarily via push and pull techniques. If the user sees negative stimuli, then the user must push it away. If the user sees positive stimuli they must pull it towards them. The goal is that overtime this will slowly train the user to form more positive cognitions associated with the selected stimuli. This can be adjusted depending on the type of stimulus needed. For the purpose of self-esteem, a selection of words will be utilized and will be sorted into self vs others categories.

This type of stimulus was conducted in a previous study using TIIM which aimed to increase positive orientation (Bingöl, 2023). The main goal of the current CBM intervention, however, is to raise both implicit and explicit self-esteem and to evaluate the effectiveness of app based CBM utilizing the TIIM app. A previous study utilizing this app targeting positive orientation, using a methodology and stimuli very similar to this intervention but with different word stimuli, found a significant effect on positive orientation (Bingöl, 2023). This previous intervention was slightly altered to better fit with the goal of the current intervention which is to raise self-esteem. Another study also conducted on the TIIM app aimed to reduce stress symptoms in students and conducted a three-week intervention but did not find a significant effect on daily mood, stress management self-efficacy, sleep quality, and stress over the three-week intervention period (Caris, 2023).

In conclusion, while the TIIM app has shown promise in some interventions, research on its effectiveness, particularly with the CBM platform, is limited and shows mixed results. For instance, while one study using a similar methodology found a significant effect on positive orientation, another study targeting stress reduction in students did not yield significant results. Further research is needed to determine the efficacy of the TIIM app and CBM training in enhancing self-esteem. Therefore, this particular study will focus on self-esteem and a CBM intervention designed with the intention to raise self-esteem.

1.7 Study overview

The primary aim of this study was to explore if implicit self-esteem can be increased through the use of a CBM matching intervention utilizing a matching exercise on the TIIM app. Depressive symptoms will be measured along with perceived feelings of stress and anxiety via the PSS (Perceived Stress Scale) and the HADS (Hospital Anxiety and Depression Scale) both pre and post intervention. Furthermore, mental wellbeing will be measured via the WEMWBS (The Warwick-Edinburgh mental wellbeing scale) both post and pre intervention. Therefore, examining effects on symptoms of depression, stress and anxiety, and mental wellbeing is a secondary aim.

1.8 Research Questions, and Hypothesis

This study investigates the relationship between implicit self-esteem, depressive symptoms, and anxiety, examining the potential of Cognitive Bias Modification to modify ISE and alleviate these symptoms. While the link between self-esteem and depression is well-established, the specific role of ISE remains less understood (Zeigler-Hill, 2006). Furthermore, although previous research suggests a less direct effect of self-esteem on anxiety (Sowislo & Orth, 2013), we predict that ISE will positively correlated with a reduction in depression and anxiety symptoms. Given the demonstrated efficacy of CBM in enhancing positive orientation (Bingöl, 2023), we hypothesize the following:

- **Hypothesis 1:** CBM will lead to a positive change in ISE.
- **Hypothesis 2:** Increased ISE will be associated with an increase in explicit self-esteem.
- **Hypothesis 3:** Changes in ISE will be significantly related to reduced depressive symptoms.
- **Hypothesis 4:** Changes in ISE will be significantly related to a reduction in anxiety symptoms.

2. Methods

2.1 Design

Data for this pilot study was collected in the months of June through July 2024. The study was approved by the University of Twente's Ethics Committee BMS/Domain Humanities and Social Science (Request nr. 230191). This study employed an uncontrolled pre-posttest design to investigate the impact of a three-day intervention delivered via the TIIM smartphone app. The current CBM intervention will be done for 3 sessions 2 times per day via either a computer or smartphone app. This makes it easily accessible for the user. Furthermore, a sorting process involving 101 words associated with either self, other, positive or negative

associations will be utilized during the matching and sorting game. The intended sample size was 20 participants. However, only 18 valid cases were analyzed. Implicit self-esteem, the primary outcome, was measured pre- and post-intervention using an Implicit Association Test game administered on a computer. Secondary outcomes which included depressive symptoms, perceived stress, and anxiety, were assessed pre- and post-intervention using the Hospital Anxiety and Depression Scale and the Perceived Stress Scale; and mental wellbeing, measured pre- and post-intervention using the Warwick-Edinburgh Mental Wellbeing Scale. Participants initially completed a battery of surveys on a computer or laptop assessing explicit self-esteem, depression, stress, anxiety, and mental wellbeing. Following pretest, they received an email invitation to engage with the TIIM app intervention on their smartphones for three days, completing exercises twice daily for 10 minutes per day. After the intervention, participants were invited via email to complete post-intervention assessments, including the IAT and psychometric measures, on the computer.

2.2 Participants

Participants were recruited via snowball sampling and SONA systems. SONA is a system in which students can receive mandatory credits for participating in research. SONA participants received 1.75 research credits for their participation. All participants were fully informed of the study's purpose and that it may influence self-esteem. The only inclusion criteria were that participants must be at least 18 years old. In total, 18 recruited participants were considered to be valid cases which were usable for data analysis. There were 12 female participants and 6 male participants. The average age was 25 ($SD = 11.41$) years.

2.3 Materials

2.3.1 Perceived Stress Scale (PSS-10)

The PSS is a widely used scale to measure a person's perception of stress. It asks questions primarily about how stressed a person feels based on their perception of appraisal of their feelings and thoughts instead of being based off of life events as many scales have done prior. Over the past few decades, Studies have demonstrated the reliability and validity of the PSS-10 across multiple cultures (Siqueira, 2008). For this study's purpose, the 10-item version was used because the PSS-10 has shown strong psychometric properties and is recommended by its original authors (Cohen & Williamson, 1988). PSS-10 scores range from 0-40. The PSS-10 has shown good internal consistency, with a Cronbach's alpha exceeding .70 across 12 different studies in various countries and population groups indicating good internal validity. (Lee, 2012). The construct validity of the PSS-10 has been supported through correlations with theoretically relevant constructs, such as depression, life satisfaction, and overall health (Reis et al., 2019).

2.3.2 HADS

The Hospital Anxiety and Depression Scale (HADS) is a widely used assessment tool designed to measure symptoms of anxiety and depression in both clinical and non-clinical populations (John, 2011). It is a 14-item self-report scale that includes seven items for the assessment of anxiety and seven items for the assessment of depression. Scores range from 0-21 with a separate sub score for both depression and anxiety. The scale has been extensively validated and is known for its strong psychometric properties, making it a reliable instrument for screening, and monitoring mental health issues in various medical settings. Multiple studies of the psychometric properties of the HADS have concluded that it has adequate sensitivity, case finding ability, concurrent validity, and internal consistency (Bjelland, 2002).

Studies show high internal consistency: Cronbach's alpha for HADS-A ranges from .68 to .93 (mean .83) and for HADS-D from .67 to .90 (mean .82) (Herrmann, 1997). The HADS will be used at both pre and posttest intervals in this study to assess changes in anxiety and depression symptoms. However, due to an input error during the study creation the scales maximum score is reduced to 18. This discrepancy, affecting all participants equally, reduces the potential range of scores but does not alter the fundamental structure of the measure. As the HADS utilizes a simple summation of item scores, the omission of items effectively shortens the scale without distorting the relative weight of remaining items. Therefore, while acknowledging this limitation, we interpret the obtained depression scores as reflecting the intended construct. Also, the analyses primarily focus on within-subject changes in depression scores rather than comparisons to population norms, further mitigating the impact of this scoring discrepancy.

2.3.3 Rosenberg Self-esteem Scale

The Rosenberg Self-Esteem Scale (RSES) is a 10-item scale with scores ranging from 0-30. It is one of the most widely used instruments for measuring global self-esteem. The Rosenberg Self-Esteem Scale has been utilized extensively in empirical research to explore the relationship between self-esteem and a wide range of psychosocial factors, including smoking cessation, obesity, depression, anxiety, eating disorders, and childhood abuse. The reliability of RSES has been confirmed through several different studies across a wide variety of cultures reporting alpha reliability scores ranging from 0.72 up to 0.90 (Akhter, M S., & Ferdous, 2019)

The Rosenberg Self-Esteem Scale is a widely used measure of self-esteem, known for its simplicity in administration, scoring, and brevity. It is frequently used by researchers as a straightforward assessment of positive or negative self-perception. The RSES has demonstrated validity across multiple adult demographic groups in the U.S., although

differences in self-esteem levels between certain groups were observed. Additionally, research suggests the RSES is a potentially valid measure for use with adolescents in the UK (Bagley, & Mallick, 2001; Sinclair, et al., 2010).

2.3.4 WEMWBS

The Warwick-Edinburgh Mental Well-being Scale (WEMWBS) is a 14-item scale with scores ranging from 14-70. It is a widely used instrument for measuring an individual's overall well-being. Studies have found that the WEMWBS demonstrates high internal consistency. The Warwick-Edinburgh Mental Well-being Scale was developed through a rigorous process involving expert consultation, qualitative research, psychometric testing, and validation using student and representative population samples, demonstrating its reliability and validity as a measure of mental well-being (Bass, et al. 2016).

One study found that the scale demonstrated high internal consistency, though the Cronbach's alpha scores suggest some redundancy in the items. The Cronbach alphas were 0.89 for the student sample and 0.91 for the population sample respectively. The WEMWBS correlated highly with similar measures of mental health and well-being, and it correlated less strongly with measures of overall health. Data collected from a population sample yielded a near normal distribution, and researchers did not observe ceiling effects. Additionally, the researchers found a high test-retest reliability coefficient (0.83) after one week. Finally, the researchers concluded that the WEMWBS is a psychometrically sound measure of mental well-being that may be particularly useful for monitoring well-being at a population level (Bass, et al., 2016). Another study also found similar findings and echoed the findings showing the WEMWBS to be a valid and reliable measure for population samples (Tennant et al., 2007).

2.3.5 Measuring Implicit Self-esteem with the ISE-IAT

An Implicit Association Test (IAT) was used to measure participants' implicit perception of word associations (Costantini, et al., 2016). The IAT, a computer-based reaction time test, assesses the strength of automatic associations between concepts (Costantini, et al., 2016). Participants were presented with various stimuli on a computer screen and tasked with categorizing them as quickly and accurately as possible using designated keys on their keyboard. The IAT, using "self vs. others" paired with "positivity" and "negativity" categories, reveals participants' unconscious self-concepts. Faster response times indicate stronger associations between concepts, while slower times suggest weaker associations. The IAT was created on SoSci Survey and administered online at www.soscisurvey.de. This was an existing and validated IAT (Leiner, 2016). The test provided immediate feedback, displaying a red "X" for incorrect categorizations, which participants had to correct before proceeding.

The IAT is scored by calculating the difference in average response times between congruent and incongruent pairings. For example, if a participant is faster, on average, at pairing "Flower" words with pleasant words and "Insect" words with unpleasant words (congruent pairing), compared to pairing "Flower" words with unpleasant words and "Insect" words with pleasant words (incongruent pairing), this would suggest an implicit association between flowers and pleasantness. This difference in response time is then standardized to account for individual variations in reaction time, resulting in a d-score that reflects the strength of implicit associations.

A positive d-score indicated a stronger association between oneself and positive concepts (high ISE), while a negative d-score indicated a stronger association between oneself and negative concepts (low ISE). A d-score of zero represented no preference for either association. This calculation involved comparing average response times across different blocks of trials, standardizing the differences, and then averaging the resulting values (Nosek, et al., 2011).

While IAT techniques are widely used, their validity in measuring constructs like ISE has been debated. Some studies have reported low correlations between IAT measures and self-report measures of personality traits, suggesting they might be assessing distinct but related constructs (Siers & Christiansen, 2013). This difference could stem from numerous factors, including the IAT's sensitivity to cognitive control processes rather than solely reflecting implicit attitudes (Siegel et al., 2012).

2.4 CBM training in the TIIM application

The CBM training was conducted using the TIIM Application, a free mobile app developed by the Behavioural, Management and Social Sciences Lab at the University of Twente. TIIM is a versatile tool that enables users to design and implement various research projects, including surveys, longitudinal studies, and interventions (van 't Klooster et. al., 2024). TIIM also allows users to build and administer targeted CBM trainings.

The CBM training, administered through the TIIM app twice daily for three days, aimed to positively influence participants' implicit self-esteem. It is important to note a key distinction between traditional CBM training and the use of an IAT in this study. While CBM training typically focuses solely on *bias-incongruent* pairings to modify biases, this study investigates the potential of an adapted IAT, incorporating elements of CBM, to achieve similar modification effects (J M., & Amir, 2017). Unlike a standard IAT that uses a balanced presentation of congruent (e.g., self-negative) and incongruent (e.g., self-positive) pairing tasks to measure existing biases, this study's IAT presented a higher frequency of bias-incongruent pairings. This

manipulation aimed to leverage the repeated association of "self" with positive attributes and "others" with negative attributes to induce a shift in implicit self-esteem (Sălăgean, 2017).

Participants engaged in a categorization task, swiping words (identical to those used in a standard IAT) towards either "Me/Positivity" or "Others/Negativity" (see Fig. 1). The app provided immediate feedback through color-coded category labels and auditory cues, allowing participants to correct and remember their mistakes. As participants swiped, the "bubble" containing the stimuli would either grow larger or smaller. A negative stimulus swiped towards "Others/Negativity" would shrink, creating a push or minimization effect. Conversely, a positive stimulus pulled towards "Me/Positivity" would grow larger. This design further reinforced the association between "self" and positivity by consistently placing those stimuli in the lower part of the screen, enhancing the feeling of pulling them towards the self.

The training, administered twice daily for three days, involved a categorization task where participants swiped words towards either "Me/Positivity" or "Others/Negativity," receiving immediate feedback (see Fig. 2). Furthermore, the dose of each stimulus was considered. 80 of the stimuli for each session were positive/negative words such as "happy" or "insecure". 40 of the words had to do with me/other categories such as "I" or "other". This intervention is a partial replication of a previous intervention conducted using the TIIM app (Bingöl, 2023). However, minor changes were made, and the variables measured were slightly altered. Some words in the positive/negative category were slightly altered to make them more relevant to self-esteem instead of positive orientation.

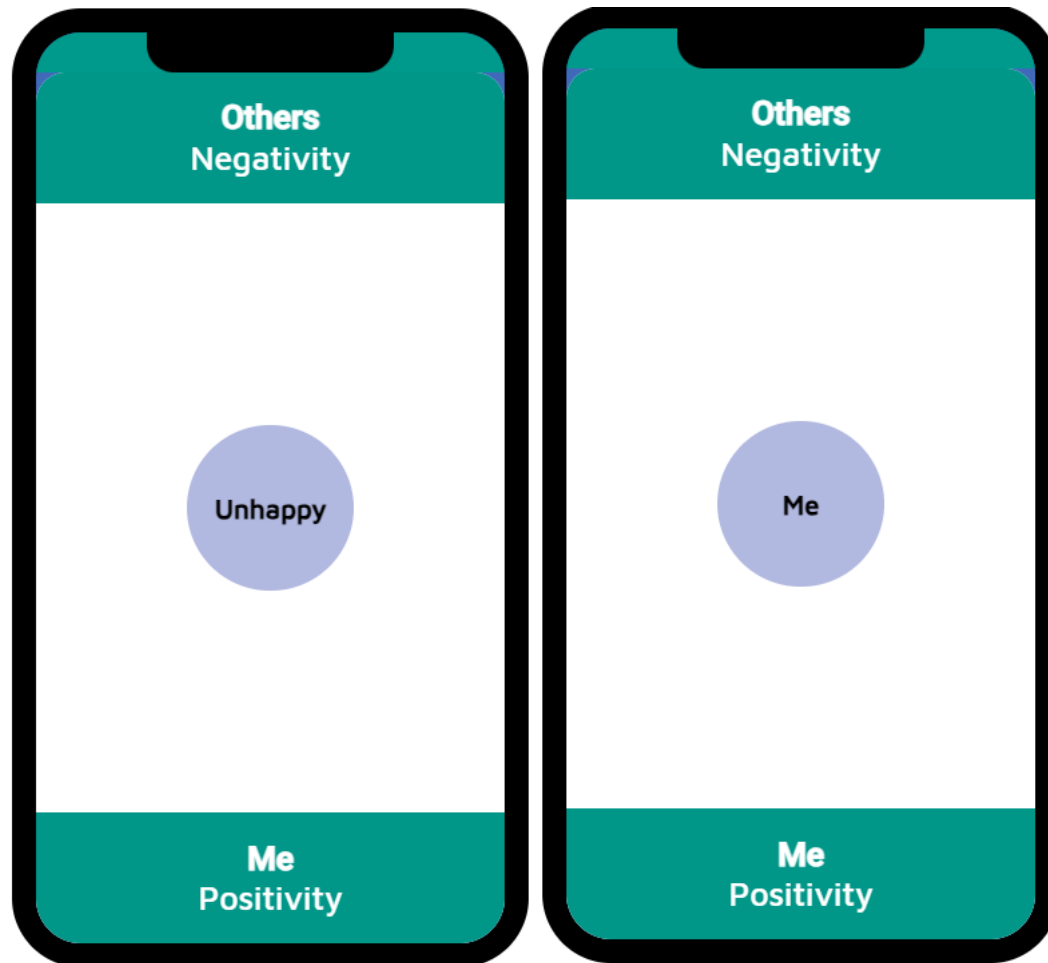
Figure 1

List of stimuli for each category

Positivity	Negativity	Me/Self	Others
High esteem	Low esteem	I	Others
Confident	Insecure	Me	Them
Happy	Unhappy	Myself	They
Satisfied	Unlikeable	Mine	Their
Lovely	Dissatisfied		
Positive	Arrogant		

Figure 2

Example of the CBM app interface in TIIM



2.5 Procedure

To participate in the study, participants either received a direct link from the researcher or signed up via SONA. After receiving the link or signing up via SONA, participants received a link to the SoSci website with information about the study and the informed consent form. Participants received a brief overview of the study's purpose. They were explicitly informed that participation was entirely voluntary, withdrawal was possible at any point, and researchers could be contacted for questions or concerns. After providing consent, participants completed a demographic questionnaire, providing information about their age, gender, nationality, and educational background. Finally, they submitted their email addresses, which were used solely for research communication regarding next steps, and not retained in the dataset or shared with external parties.

The participants that signed up for the study received a link to start the pre-tests via SONA or a direct message if interest was expressed in person. The participants were then asked to take pretest surveys. After completing the pre-tests, participants received instructions

for downloading the TIIM App. After they downloaded the TIIM App and created an account, participants were assigned to the CBM training. Then, the participants could complete the first session, and the second session two hours after completing the first session of the day. Each training was automatically triggered and made available in the app. Participants were also given a notification. This continued for three days, allowing participants flexibility in choosing their training locations and receiving phone notifications when sessions were available. If a session was missed, reminder notifications were sent three and six hours after the initial notification. The session would then remain available indefinitely. However, if a participant took too long to complete the intervention this could be seen when they began the posttest.

After three days, the intervention and the control group received an email to complete the post-tests, which were identical to the pre-tests. If not completed, they received a reminder email to complete the post-tests after one day.

2.6 Data analysis

Prior to conducting primary analyses, data were screened for missing values and outliers. Outliers were excluded due to nonresponse and the IAT detecting random response patterns or too many errors. If participants made too many errors too quickly their score would be given a -9 on the IAT. This would automatically eliminate them from the dataset. The assumption of normality was assessed for each variable at both pre-test and post-test using the Shapiro-Wilk test. Visual inspection of histograms was also conducted to assess normality.

To examine the relationships between changes in study variables, change scores were calculated for explicit self-esteem, anxiety, depression, perceived stress, and mental well-being by subtracting the baseline (T1) score from the post-intervention (T2) score for each participant. The following hypotheses were tested:

- *Hypothesis 1:* Cognitive Bias Modification will lead to a positive change in ISE.
A paired samples test was conducted to compare the mean change in ISE scores from pretest to posttest. A significant test result is expected, indicating that the CBM intervention led to an increase in ISE.
- *Hypothesis 2:* The positive effect of increased ISE will have a "spillover" effect and increase ESE.
A bivariate correlation will be used to examine the relationship between the change in ISE and the change in ESE scores. A significant positive correlation is expected, indicating that as ISE increases, ESE also increases.
- *Hypothesis 3:* Changes in ISE will significantly impact and reduce depressive symptoms.

To test this hypothesis, a bivariate correlation will be conducted to examine the relationship between the change in ISE and the change in depression scores. A significant negative correlation is expected, indicating that as ISE scores improved, depressive symptoms decreased.

- *Hypothesis 4:* Changes in ISE will also contribute to a slight reduction in anxiety symptoms, despite previous research suggesting a less direct effect of self-esteem on anxiety.

Similar to Hypothesis 3, a bivariate correlation will be used to examine the relationship between the change in ISE and the change in anxiety scores. A significant negative correlation, though potentially weaker than the correlation with depression, is expected.

Parametric (paired *t*-test and Pearson correlations) will be reported if variables meet the assumption of normality. Spearman's rank-order correlations will be employed if the normality assumption is violated for any of the change score variables. Additionally, a Wilcoxon signed-rank test will be conducted as an alternative to the paired sample *t*-test if normality is not met. All analyses will be conducted using RStudio with statistical significance set at $p < .05$.

3. Results

3.1 Descriptive Statistics

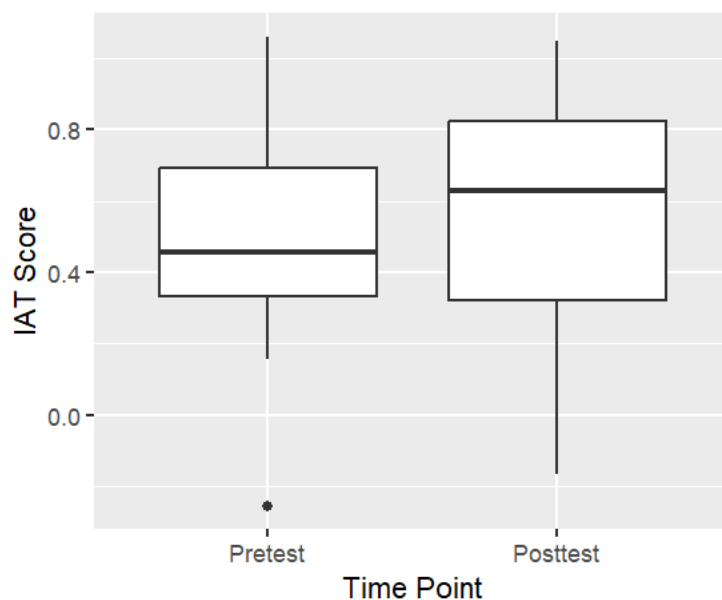
The descriptive statistics for the different measurements at pre- and post-test are presented in table 1. IAT scores for ISE (see also Fig. 3) marginally improved post intervention, while explicit self-esteem as measured by the RSES showed no numerical improvement post intervention. The HADS which has one subsection for anxiety and the other for depression, also showed no improvement in mean scores post intervention. Wellbeing scores as shown by the WEMWBS showed small marginal improvements in mean and SD scores.

Table 1
pretest and posttest of psychometrics and IAT tests

	Pretest				Posttest			
	M	SD	Min	Max	M	SD	Min	Max
IAT	0.42	0.34	-0.24	0.93	0.6	0.29	0.06	1.09
RSES	20.38	3.79	13	30	19.72	2.84	16	27
HADS_A	9.44	2.91	4	14	9.05	4.02	3	21
HADS_D	3.5	2.54	0	11	3.83	2.57	0	8
PSS	21.38	5.42	4	29	20.44	5.99	4	31
WEMWBS	50.61	6.33	36	67	55.94	5.73	46	70

Note: IAT = Implicit Association Test, RSES = Rosenberg Self-Esteem Scale. HADS_A=HADS-Anxiety, HADS_D= HADS Depression, PSS=Perceived Stress Test, WEMWBS= Warwick-Edinburgh Mental Wellbeing Scale

Figure 3.
Implicit Self-esteem Pretest vs Posttest



3.2 Preliminary analysis

The assumption of normality was violated for RSES scores and the change in implicit self-esteem scores. Therefore, a Wilcoxon signed-rank test was used to examine pre- and post-

intervention differences in implicit self-esteem. Spearman's rank-order correlations were employed to examine the relationships between changes in implicit self-esteem and changes in depression, anxiety, and explicit self-esteem.

3.3 Hypothesis Testing

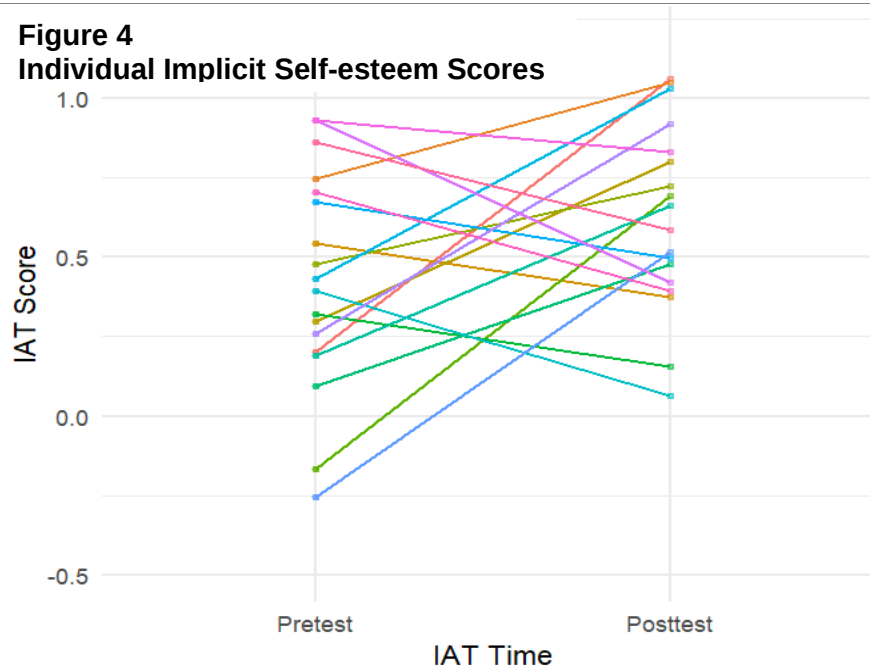
Hypothesis 1: A Wilcoxon signed-rank test was conducted to determine whether the CBM intervention led to a significant increase in implicit self-esteem. The results indicated that the intervention led to an expected statistically significant increase in ISE scores from pretest ($Mdn = 0.41$, $IQR = 0.48$) to posttest ($Mdn = 0.62$, $IQR = 0.39$; $V = 125$, $p = .045$). Individual changes in IAT scores are visualized in Fig. 4.

Table 2

Wilcoxon signed-rank test results

<i>Measure</i>	<i>Pretest</i>		<i>Posttest</i>		<i>V & P-value</i>	
	<i>Mdn</i>	<i>IQR</i>	<i>Mdn</i>	<i>IQR</i>	<i>V</i>	<i>P</i>
<i>IAT</i>	<i>0.41</i>	<i>0.48</i>	<i>0.62</i>	<i>0.39</i>	<i>125</i>	<i>.045</i>

Figure 4
Individual Implicit Self-esteem Scores



Hypothesis 2: To examine the relationship between changes in implicit and explicit self-esteem, a Spearman's rank correlation was conducted to assess the association between changes in ISE scores and changes in RSES scores. The results indicated a non-significant, weak positive correlation between the two variables ($\rho = .03$, $p = .898$). This finding suggests that changes in ISE were not significantly associated with changes in ESE. Therefore, Hypothesis 2, which predicted a significant positive correlation, was not supported.

Hypothesis 3: It was hypothesized that change in implicit self-esteem, from pre- to post-intervention, would be significantly and positively correlated with change in depression scores from pre- to post-intervention. Spearman's rank-order correlation analysis revealed a moderate positive, but non-significant, correlation between change in implicit self-esteem and change in depression scores ($\rho = .38$, $S = 597$, $p = .12$). This suggests that there was no statistically significant tendency for individuals with greater increases in implicit self-esteem to also experience greater reductions in depression symptoms. Therefore, the hypothesis was not supported.

Hypothesis 4: It was hypothesized that changes in implicit self-esteem from pre- to post-intervention would be significantly and positively correlated with a reduction in anxiety symptoms. A Spearman's rank-order correlation analysis revealed a weak, positive correlation between changes in ISE and changes in anxiety; however, this correlation was not statistically significant ($\rho = .18$, $S = 794.55$, $p = .475$). This suggests that there was no statistically significant tendency for individuals with greater increases in ISE to also experience greater reductions in anxiety. Therefore, Hypothesis 4 was not supported.

4. Discussion

4.1 Summary of Findings

Overall, the study confirmed an expected significant increase in ISE after the 3-day CBM, which confirms the short-term efficacy of the intervention (hypothesis 1). However, changes in ISE scores were not significantly correlated with changes in ESE, depression or anxiety symptoms. These findings indicate that the observed increases in ISE following the CBM intervention were not directly associated with improvements in ESE or reductions in psychological distress measures within the current sample.

4.2 Interpretation of Results

Implicit Self-Esteem Enhancement Through CBM

Hypothesis 1: The CBM intervention will lead to a significant increase in implicit self-esteem scores from pretest to posttest.

The main finding of this study suggests that the CBM intervention was successful in enhancing participants' implicit self-esteem, aligning with previous research indicating the potential of CBM in modifying implicit attitudes and beliefs (Wallaert et al., 2010). The finding that the CBM intervention significantly increased implicit self-esteem suggests that even brief CBM interventions, such as the one used in this study, have the potential to shift these deeply ingrained associations. Similarly, one previous study found that a constructed CBM training was effective in modifying attentional bias regarding tiredness and vitality (Klaus, 2016). Other studies have also tried to modify behavioral biases. One study tried to do this with alcohol. This pilot study had more than a thousand participants with 93.5% being categorized as “problem drinkers”. The CBM involved changing implicit associations with alcohol via a swiping game smartphone game utilizing a methodology similar to the current intervention. The CBM intervention resulted in a significant reduction in weekly drinks (Somsen, 2017).

Relationship Between Implicit and Explicit Self-Esteem

Hypothesis 2: Changes in ISE scores will be significantly associated with changes in ESE scores.

Contrary to expectations, changes in implicit self-esteem were not significantly correlated with changes in explicit self-esteem. This suggests that the CBM intervention, while effectively influencing implicit self-evaluations, did not have a significant impact on participants' conscious and reflective self-worth. This highlights the potential dissociation between implicit and explicit self-esteem, indicating that these constructs may operate independently, at least in the context of this intervention.

Implicit Self-Esteem and Depressive Symptoms

Hypothesis 3: Higher Implicit self-esteem scores will lead to a reduction in depressive symptoms.

This indicates that the improvement in implicit self-esteem observed after the CBM intervention was not significantly associated with a reduction in depressive symptoms. This finding suggests that other factors, beyond implicit self-esteem, might play a more prominent role in influencing depressive symptomology.

Implicit Self-Esteem and Anxiety Symptoms

Hypothesis 4: Higher implicit self-esteem scores will lead to a reduction in anxiety symptoms. The results also did not support the hypothesis that increases in implicit self-esteem would be associated with reductions in anxiety symptoms. This finding further emphasizes the complex

interplay between implicit processes, such as self-esteem, and emotional experiences like anxiety, suggesting that targeting implicit self-esteem alone might not be sufficient to induce significant changes in anxiety.

The study's limitations, particularly the small sample size and the brief intervention period, should be considered when interpreting these findings. It is possible that a longer intervention period or a larger sample size would reveal more robust relationships between changes in implicit self-esteem and changes in mental health metrics. Future research should explore these possibilities to further elucidate the potential for CBM interventions to contribute to lasting improvements in overall mental health.

4.3 Implications

The finding that the CBM intervention led to a statistically significant increase in ISE scores from pre-test to post-test suggests that even a brief CBM intervention can positively influence implicit self-esteem. This promising result highlights the potential of CBM techniques to improve implicit self-views, even within a short intervention period. However, despite this increase in ISE, the study did not find statistically significant relationships between changes in implicit self-esteem and changes in depression, anxiety, or explicit self-esteem. This suggests that the relationship between these constructs may be more complex than initially hypothesized.

The lack of significant correlations between ISE improvements and changes in depression, anxiety, or explicit self-esteem underscores the multifaceted nature of self-esteem. It may indicate that while CBM can enhance implicit self-esteem, these improvements do not necessarily or immediately translate into broader psychological outcomes. This points to the potential need for multi-component interventions that target both implicit and explicit aspects of self-worth to achieve more comprehensive and lasting improvements in well-being.

Further research is warranted to explore this complexity, particularly by examining potential mediators, such as emotion regulation, self-efficacy, or social support, which might clarify how changes in ISE lead to broader psychological outcomes. Additionally, investigating potential moderators like trauma history, personality, attachment style, or cultural background could provide insight into individual differences that influence the effectiveness of CBM interventions.

While this study did not find a direct relationship between changes in ISE and reductions in depression or anxiety, previous research suggests that CBM may still hold therapeutic potential for these conditions. For example, studies have demonstrated that interventions targeting selective attention or interpretation can reduce vulnerability to anxiety and improve dysfunctional anxiety symptoms, highlighting the significant role of cognitive bias in anxiety

(MacLeod & Mathews, 2012). Additionally, a meta-analysis revealed that CBM showed promising results for depression, although the effect was greater for anxiety (Hallion & Ruscio, 2011).

Overall, this study contributes valuable insights for future research. It suggests that while CBM techniques can effectively improve implicit self-esteem, their impact on broader psychological outcomes may require more targeted or integrated approaches. Further investigation with larger samples and more robust methodological designs is necessary to explore the potential synergistic effects of combining CBM with other therapeutic interventions to address both implicit and explicit aspects of self-esteem.

CBM's potential lies in its ability to target a root cause of low self-esteem: deeply ingrained, automatic negative self-associations. By directly addressing these implicit beliefs, CBM could create a foundation for more lasting change. Furthermore, combining CBM with established therapies like Cognitive Behavioral Therapy could yield synergistic effects. While CBT addresses conscious negative thoughts (Larsson 2016), CBM could simultaneously tackle underlying implicit biases, leading to a more comprehensive approach. Understanding a client's ISE levels could also further enhance treatment personalization, as those with highly discrepant implicit and explicit self-esteem might benefit most from combined approaches.

However, it is crucial to recognize that improvements in ISE alone may not equate to global improvements in well-being. Feeling better about oneself encompasses more than just implicit associations; it involves mood regulation, healthy relationships, and overall functioning, all of which contribute to well-being (Larson, 2008). Moreover, the long-term impact of CBM-induced ISE changes remains unclear. Further research is needed to determine the stability of these effects and whether ongoing "booster" sessions are necessary to maintain them.

4.4 Limitations

This study was especially limited by its small sample size ($N = 18$) and the relatively brief duration and dosage of the CBM intervention. The intervention, consisting of two 10-minute sessions per day over three days, may have been too limited to produce robust or statistically significant changes in all measures. While the IAT matching game intervention showed a positive effect in increasing ISE, the small sample size may have limited the study's statistical power to detect significant effects of changes in ISE on other measures such as anxiety and depression. Future research should employ larger samples and explore the effects of more intensive and prolonged CBM interventions to further evaluate their potential to enhance both implicit self-esteem and broader aspects of well-being. Incorporating additional measures of self-esteem and psychological well-being could also provide a more comprehensive

understanding of the intervention's effects. These methods could include behavioral observations, more implicit measures such as an IAT designed to measure associations related to depression anxiety and wellbeing, or a narrative or thematic analysis which involves encouraging participants to write or verbally share stories about themselves before and after the intervention which could be analyzed for changes in self-perception, agency, or outlook on life. This method allows for a more in-depth exploration of how the intervention might be affecting their self-esteem and overall well-being.

Even if the intervention proves more effective in future larger and longer studies, other concerns of this approach must be considered. One concern is the difficulty in crafting items that effectively test higher-order cognitive levels beyond just associations (Bruyn et al., 2011). There is a risk that these types of interventions may promote surface-level learning rather than deeper, more meaningful changes in self-perception and self-worth (Bruyn, et al., 2011). To explore this effect, explicit self-esteem was also measured in this study using psychometric scales along with other measurements of wellbeing. However, it is important to acknowledge that explicit measures may not fully capture the complexities of self-esteem and its multifaceted nature. Future research could benefit from incorporating qualitative data, such as interviews or open-ended questionnaires, to gain a more in-depth understanding of participants' subjective experiences and perceived changes in self-esteem following the CBM intervention.

Moreover, the study relied solely on self-report measures to assess changes in depression and anxiety symptoms. While self-report measures offer valuable insights into individuals' subjective experiences, they are susceptible to response bias and may not fully capture the nuances of these complex constructs (Rosenman et al., 2011). Future research could benefit from incorporating objective measures, such as physiological indicators or behavioral observations, to provide a more comprehensive and nuanced assessment of the intervention's impact on depression and anxiety.

Furthermore, the long-term effects of the CBM intervention on implicit self-esteem and its potential transfer effects to other areas of functioning remain unclear. Future research should investigate the durability of the observed effects and explore whether improvements in implicit self-esteem translate to meaningful changes in individuals' behaviors, relationships, and overall well-being over an extended period.

Next, relying solely on verbal cues and words in this study's CBM-IAT approach to enhance self-esteem, as opposed to incorporating images or other modalities, presents a potential limitation. While the current study design capitalizes on the established impact of verbal evaluative conditioning, research suggests that multimodal approaches might be more robust. While this

study focuses solely on verbal cues to influence implicit self-esteem, incorporating visual elements could potentially enhance the intervention's effectiveness. Research suggests that multimodal learning, which engages multiple senses, can lead to better learning outcomes than just verbal stimuli alone (Lin, 2011). Furthermore, the reliance on verbal stimuli might introduce challenges related to language proficiency and interpretation. As the study was conducted in the Netherlands with English as the primary language for the intervention, nuances in understanding and internalizing the meaning of self-affirming words could vary among participants, potentially influencing the effectiveness of the intervention.

In conclusion, while CBM games show potential, their effectiveness in durably improving self-esteem may be limited if they do not also address the complex cognitive factors and self-concept issues underlying low self-worth. For instance, individuals with low self-esteem often exhibit negative self-schemas, characterized by distorted and pessimistic beliefs about themselves. These schemas can influence how individuals interpret information, leading to self-critical interpretations and a tendency to focus on negative feedback (Franck, De Raedt & De Houwer, 2008). CBM games, while potentially effective in shifting implicit associations, may not directly address these ingrained thought patterns. Therefore, integrating CBM games with therapeutic approaches that target maladaptive cognitions, such as cognitive restructuring or schema therapy, might be a more comprehensive approach to fostering lasting self-esteem improvement.

While this study focuses on CBM using an IAT to improve self-esteem, it should be acknowledged that this approach might lead to only short-term changes and may be influenced by factors like language barriers. The limited timeframe of the study prevents us from drawing conclusions about long-term effects. A more multifaceted approach could address the complex cognitive factors and self-concept issues underlying low self-esteem, potentially leading to more durable improvements. For instance, integrating CBM with therapies like cognitive restructuring or schema therapy could help individuals identify and modify negative self-schemas leading to more profound and lasting changes in self-perception. For example, previous studies have shown that cognitive restructuring and schema therapy alone can help with negative self-perceptions (Dattilio, 2005). This could also be combined with CBM.

4.5 Future Directions

While the use of Implicit Association Test (IAT) matching games as a form of cognitive-bias modification (CBM) showed promise in addressing self-esteem issues, further research is needed to investigate ways in which the effectiveness and long-term impact of this approach can be improved. One key area for exploration could be investigating how to design more

cognitively demanding IAT tasks that promote deeper, more meaningful changes in self-perception, rather than just surface-level associations. Incorporating metacognitive components that encourage users to critically reflect on their own thought processes and self-beliefs may help facilitate more internalized, intrinsic sources of self-worth.

Additionally, exploring ways to integrate CBM IAT games with other therapeutic techniques, such as self-compassion training or narrative identity work, could help cultivate a more holistic approach to self-esteem enhancement (Hall & Tarrier, 2005). Combining implicit bias modification with explicit, self-directed activities focused on reframing negative self-narratives and building self-acceptance may lead to more robust and durable improvements in self-esteem (Hall & Tarrier, 2005).

Future studies should place a greater emphasis on measuring long-term outcomes and follow-up assessments to better understand the sustainability of any self-esteem gains achieved through CBM IAT interventions. Longitudinal research that tracks participants over an extended period would provide valuable insights into the lasting impact of this approach and help inform the development of more effective self-esteem enhancement programs.

Furthermore, the relationship between self-esteem and anxiety and depression is complex. Research shows that depression and low self-esteem are strongly related. Additionally, the combinations of explicit self-esteem (ESE) and implicit self-esteem (ISE) have different effects on depression. For instance, currently depressed individuals with suicidal ideation showed a combination of low ESE and high ISE, suggesting that the relationship between ISE and ESE itself may predict internalizing symptoms (Wiechert, et al., 2023). This finding raises questions about the specific impact of different ESE-ISE combinations. While low ESE with high ISE appears linked to internalizing symptoms in depressed individuals with suicidal ideation, the effects of the reverse discrepancy (high ESE, low ISE) warrant further investigation. However, other studies found little impact of implicit self-esteem on the effects of anxiety and depression. In a longitudinal study, ISE and ESE were not predictive of depression and anxiety in a two-year follow-up.

The discrepancy between ISE and ESE is of pivotal importance. Studies in young adults have shown that discrepancies between ISE and ESE may predict more depressive symptoms, suicidal ideation, and loneliness. This discrepancy might be due to cognitive dissonance, where an individual experiences discomfort when their external self-opinion is high, but their internal, unconscious self-opinion is low. This incongruence suggests that changing implicit self-esteem alone may not be sufficient to lower depressive symptoms.

If someone has high ESE and low ISE or vice versa, it may be necessary to ensure both are raised; if both are insufficient, then both ISE and ESE should be targeted instead of ISE alone. Furthermore, the understanding of how the association between ISE and ESE contributes to depression and anxiety remains limited. It is also not well understood how the association between ISE and ESE works and whether altering only one aspect, such as implicit self-esteem, will lead to changes in depressive symptoms. Both low implicit and low explicit self-esteem are associated with depression; however, explicit self-esteem tends to have a stronger link, and the discrepancies between ESE and ISE may be particularly relevant. For example, someone might report high explicit self-esteem but have low implicit self-esteem, which could indicate underlying vulnerability (Zeigler-Hill, 2006). It remains unclear if this will lead to improvement in the short term or if altering only one aspect of self-esteem (ISE) will lead to a change in depressive symptoms. Future research should explore whether this pattern might be associated with distinct outcomes and investigate the impact of this discrepancy.

4.6 Conclusion

This pilot study explored the impact of a CBM intervention on implicit self-esteem and its potential relationship to changes in well-being, explicit self-esteem, and symptoms of depression and anxiety. The CBM intervention resulted in a statistically significant increase in ISE. However, the hypothesized relationships between changes in ISE and changes in depression, anxiety, and ESE were not statistically supported.

Despite these non-significant findings, the significant increase in ISE following the intervention warrants further investigation. The study's limited sample size may have hindered the ability to detect statistically significant relationships between changes in ISE and other measures of well-being. Future research with more robust methodological designs and larger sample sizes is warranted to explore the potential for broader and more durable effects on self-esteem and psychological well-being.

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