FACULTY OF PSYCHOLOGY AND EDUCATIONAL SCIENCES

The effects of self-compassion on psychological and physiological stress responses in adolescents

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Background

Adolescence is a challenging and stressful period marked by substantial physical, social and emotional changes which often coincide with increased and more intense negative emotional experiences (De Veld et al., 2012; Spear, 2009). In addition, it seems that youngsters are particularly vulnerable to stress, as the period of adolescence is a major period to develop stress-related diseases such as depression and anxiety disorders (Andersen and Teicher, 2008; Polanczyk et al., 2015). These disorders show a marked increase in prevalence during this period of transition (Dahl & Gunnar, 2009; Lee et al., 2014; McCormick and Green, 2013; Patton and Viner, 2007), and one in five adolescents even develop a mental illness that will persist into adulthood (Paus et al., 2008). Furthermore, studies in humans and animals (mostly rodents) suggest that chronic stress during adolescence has negative consequences for stress adaptation later in life. Though the majority of studies explored the immediate effects of stress in adolescence (Eiland et al., 2012; Jankord et al., 2011; Romeo, 2013), some authors have also studied the long-term, lasting effects of chronic stress on subsequent behaviour and stress reactivity (e.g. Yohn and Blendy, 2017; Wulsin et al., 2016; Chaby et al., 2015; Cotella et al., 2019). The results indicate increased plasticity in the adolescent brain, resulting in incomplete maturation of the mechanisms that control responses to stress. Consequently, when exposed to stress early in life, these mechanisms exhibit disproportionate reactivity (Lee et al., 2014).

The incomplete development of affective control, which is believed to further mature during adolescence, is considered a possible mechanism contributing to this imbalanced reactivity (Schweizer and Blakemore, 2020). Affective control refers to the application of cognitive control to affective contexts, that is, the ability to regulate emotional responses in a goal-directed manner. It involves selectively attending and processing affective information that is relevant to one's goals,

while simultaneously inhibiting the processing of irrelevant or distracting affective information. Evidence suggests that affective control develops throughout adolescence into adulthood. However, as a consequence of the uneven developmental progression of different facets of affective control, the capacity to inhibit attention and responses towards distracting affective information may be reduced during adolescence compared to both childhood and adulthood. This might explain the heightened susceptibility of adolescents to stress (Schweizer and Blakemore, 2020).

Notably, not all adolescents experience difficulties in regulating affective experiences. According to the diathesis-stress model of psychopathology, each individual has an underlying predisposition (i.e. diathesis) to develop a particular psychological disorder. Environmental stressors can act as triggers for the manifestation of these disorders, but the amount or severity of stress required to trigger the disorder depends on the individual's inherent level of vulnerability (Broerman, 2017).

Several vulnerability factors have been highlighted throughout the literature. For example, a growing body of research among adults poses that impairments in executive functioning might be an important vulnerability factor for psychopathology (Joorman and D'Avanzato, 2010). Next, as previously mentioned, differences in maturation of cognitive control components, such as affective control, might also explain the heightened susceptibility of adolescents to stress (Schweizer and Blakemore, 2020). Cognitive control can be defined as the capacity to attend and respond to goal-relevant information and inhibit attention and responses to distracting, goal-irrelevant inputs (Braver, 2012). The application of cognitive control in affective contexts (i.e. affective control), is essential for developing successful emotion regulation (ER) (Schweizer and Blakemore, 2020). Consequently, ER has been proposed as one of the mechanisms that mediates the relationship

between stress and psychopathology (Moriya and Takahashi, 2013), but also between executive functioning and psychopathology such as depression (Wante et al., 2017).

To sum up, cognitive processes that are crucial in ER, like high-level executive functions, social processes (Joorman and D'Avanzato, 2010; Somerville and Casey, 2010; Blakemore and Robbins, 2012; Dumontheil, 2014) and affective control (Schweizer and Blakemore, 2020), undergo significant development during adolescence. Together with the increased challenges and changes that are associated with adolescence, youngsters may be at an increased risk for developing dysfunctional ER (Ahmed et al., 2015), as ER plays an important role in many psychopathologies across different diagnostic categories (Gross, 2013; Jazaieri et al., 2013).

Given the widespread influence of ER difficulties across various psychopathologies, several authors propose to adopt a transdiagnostic perspective towards ER. This approach considers ER as a factor or construct within the transdiagnostic theory (Cludius et al., 2020; Fernandez et al., 2016), playing a key role in the development and/or persistence of several different disorders, rather than studying it only within the traditional context of a specific disorder (Fernandez et al., 2016; Aldao, 2016; Schäfer et al., 2017). In line with transdiagnostic theory, there is evidence suggesting that risk factors linked to a particular disorder may also confer risk of other disorders, especially those that have high rates of comorbidity or overlap in symptoms (e.g. Gentes and Ruscio, 2011). Therefore, to understand and treat psychopathology, it has been suggested to prioritize transdiagnostic factors that can influence various forms of mental illnesses, instead of treating and examining risk factors for each specific disorder (e.g. Aldao et al., 2010; Buckholtz and Meyer-Lindenberg, 2012). With stress-related psychological and physiological disorders showing an increased prevalence during adolescence, this time period may present a crucial developmental window of opportunity to influence a transdiagnostic factor like ER (Ahmed et al., 2015).

Emotion Regulation

ER refers to the processes that individuals use to influence which emotions they have, when they have them, and how they experience and express these emotions (Gross, 1998). Several strategies can be used to regulate emotions, and can be placed on a dimension ranging from maladaptive to adaptive (Aldao et al., 2010). These strategies refer to the way in which individuals actively and in a goal-oriented manner regulate their emotions (Gross, 1999).

According to the paper by Schäfer et al. (2017), three prominent adaptive ER strategies can be distinguished: (i) cognitive reappraisal, (ii) problem solving and (iii) acceptance. *Cognitive reappraisal* involves altering thoughts and beliefs about the meaning of a situation (Aldao et al., 2010). Moreover, less use of cognitive reappraisal is associated with higher depressive and anxiety symptoms (Eastabrook et al., 2014; Lanteigne et al., 2014). Next, *problem solving* can be considered an effective ER strategy as it utilizes cognitive and behavioural tactics to modify unfavorable circumstances that trigger negative feelings (Frye and Goodman, 2000). Finally, the authors posed *acceptance* as a third adaptive ER strategy, which can be described as allowing one's reactions to unfold, without any form of resistance (Werner and Gross, 2010). This strategy has been empirically proved to be effective, and is associated with lower levels of depressive and anxiety symptoms (Weinberg and Klonsky, 2009).

Apart from these three adaptive ER strategies, Schäfer et al. (2017) also proposed three maladaptive ER strategies: (i) avoidance, (ii) suppression and (iii) rumination. The authors highlight two different applications of *avoidance* as a maladaptive ER strategy: (1) *experiential avoidance*, referring to avoiding internal psychological events, and (2) *behavioural expressions of avoidance*, including the avoidance of situations or external stimuli (Werner and Gross, 2010). Avoidance might seem adaptive at first, as it initially reduces negative emotions. However, its psychological

long-term costs outweigh its benefits, as it is associated with depressive and anxiety symptoms (Siu and Shek, 2010), and may result in the persistence of the negative emotions an individual is trying to avoid (Werner and Gross, 2010). Next, *suppression* is described as a maladaptive ER strategy, since it also implies negative long-term consequences for mental health. Habitually using suppression is linked to increased depressive and anxiety symptoms (Eastabrook et al., 2014). Lastly, the authors describe *rumination* as a third and final maladaptive ER strategy. Rumination refers to the persistent contemplation of emotional experiences, their causes, and outcomes (Nolen-Hoeksema et al., 2008). It has been associated with internalizing psychopathologies in adolescents, like anxiety and depression (McLaughlin et al., 2011).

Self-compassion as an Emotion Regulation strategy

Recently, self-compassion (SC) has been discussed in the literature as another potentially adaptive strategy to cope with negative emotions (Gilbert and Procter, 2006; Neff, 2003), and has theoretical connections to mindfulness (Birnie et al, 2010). According to Neff (2003), the construct consists of three bipolar components: (i) self-kindness versus self-judgement, (ii) common humanity versus isolation, and (iii) mindfulness versus overidentification. The first component involves the ability to treat oneself with understanding and care in times of pain or failure rather than being critical and judgemental towards oneself. The second component reflects the recognition that imperfection and failures are normal, shared aspects of humanity, rather than experiencing them as stigmatising and isolating. The third component refers to being mindful and accepting of experiences, in contrast to overidentifying with emotions and thoughts (Diedrich et al., 2014). The main focus of SC is the affective experience itself, which is crucial for emotional processing and is less cognitively demanding than other ER strategies such as cognitive reappraisal (Gotlib et al., 2010). Furthermore, researchers have proposed that SC can help stabilize negative emotional arousal

triggered by a stressor, thereby catalysing the subsequent use of more cognitively demanding ER strategies like cognitive reappraisal (Berking et al., 2014a; Diedrich et al., 2016).

However, there is still an ongoing debate throughout the literature about whether SC can be considered an ER strategy, or merely an important factor in using adaptive emotion regulation strategies. Among several ER models, two major classes can be distinguished: (i) Strategies-based Models and (ii) Skills-based Models (Paucsik et al., 2022).

First, Strategies-based Models consider that effective ER relies on the utilization of strategies categorized as adaptive, while minimizing the use of maladaptive strategies. This traditional classification is based on the correlation between psychopathology and maladaptive strategies, and the association between good mental health and adaptive strategies (Aldao and Nolen-Hoeksema, 2010, 2012; Hu et al., 2014). More recently however, studies on emotional flexibility have gone beyond this dual categorisation of adaptive versus maladaptive ER strategies: a large body of research demonstrates that the flexible use of a wide range of adaptive and maladaptive strategies results in less psychopathology, less negative affect, and more emotional well-being in general, depending on the context (see reviews by Barnow and Schulze, 2020; Aldao and Gross, 2015; Kobylińska and Kusev, 2019).

Secondly, Skills-based Models, like the Adaptive Coping with Emotion model (ACE) by Berking and Whitley (2014), conceptualize adaptive ER as the interaction of multiple skills that facilitate the implementation of ER strategies. These skills include (i) being aware of one’s emotions, (ii) accurately identifying and labelling perceived emotions, (iii) correctly interpreting bodily sensations, (iv) comprehending the factors that may have contributed to and maintained those emotions, (v) the ability to adjust the intensity or duration of one's emotions in an adaptive manner, (vi) to accept and tolerate undesired emotions, (vii) to confront certain situations, and finally (viii)

to be able to provide effective self-support in undesirable situations (Berking and Whitley, 2014). Acquiring these skills would then enable individuals to select and use adaptive ER strategies. Indeed, as shown by Berking et al. (2012), the relationship between ER skills and mental health would be mediated by the use of ER strategies. More specifically, higher levels of ER skills could lead to increased use of adaptive ER strategies and decreased use of maladaptive ones. This hypothesis is supported by empirical evidence from several studies and meta-analyses (e.g. Berking et al., 2011; Aldao and Nolen-Hoeksema, 2010). In this model, SC is seen as an important final skill that facilitates the use of adaptive ER strategies.

There is empirical evidence for the classification of SC in both types of models. For example, Paucsik et al. (2022) provide evidence in support of the Skills-based Models, suggesting that developing SC can be crucial to further develop general ER skills, both of them resulting in potential better application of ER strategies. In that perspective, SC could serve as a valuable motivation for building a strong foundation towards the improvement of ER skills and later adaptive ER strategies used, making it a facilitator to use other more active ER strategies (Berking and Whitley, 2014). In contrast, Diedrich et al.'s (2014) paper is an illustration of a study that aligns more closely with the Strategies-based models. They directly compared the efficacy of SC with those of other active and already established ER strategies and found that on average, SC was equally effective as cognitive reappraisal and acceptance with regard to down-regulating a depressed mood. Accordingly, SC in itself can be used to regulate the arousal that accompanies an emotional experience.

The present research paper will take both perspectives on SC into account by examining the effect of SC on its own, as well as investigating SC as a facilitator for the use of other adaptive ER strategies in adolescents. By thoroughly exploring both views on SC, the current study aims to shed light on the impact of (trained) SC on psychopathology, psychological affective responses, and

physiological responses. Furthermore, gaining a deeper understanding of the effects of SC on these domains would yield valuable insights into the effectiveness and relevance of SC interventions in promoting adaptive ER strategies among adolescents.

The effects of self-compassion

Psychopathology

A substantial body of research has already studied the relationship between SC and psychopathology, often making the distinction between trait SC (scoring high or low on a SC questionnaire), trained SC (the result of a SC intervention or training) and induced SC (the impact of priming SC). Overall, the literature indicates that SC is relevant to psychological well-being (e.g. Diedrich et al., 2014; Werner et al, 2012; Fresnics et al., 2019; Muris et al., 2017). Specifically, meta-analytic work and literature reviews indicate that both trait and trained SC are associated with higher emotional well-being, less anxiety, less depression and less stress in adults (e.g. Kirby et al., 2017; Neff and McGehee, 2010; MacBeth and Gumley, 2012). Regarding induced SC, a study by Kirschner et al. (2019) on healthy university students revealed that the induction of SC is associated with less self-criticism and more self-compassion compared to a control group.

Studies in adolescents reveal similar trends (e.g. Bluth and Eisenlohr-Moul, 2017; Muris et al., 2016; Lathren et al., 2019). Marsh et al. (2018) conducted a meta-analysis consisting of 19 relevant studies of the effects of SC in adolescence. They included studies investigating both trait and trained SC, but no studies examining induced SC. Their analyses revealed a large effect size for an inverse relationship between SC and psychological distress, as measured by anxiety, depression and stress. These findings replicate those found in adult samples, indicating that insufficient SC may contribute to the development and/or maintenance of emotional difficulties in adolescents.

Psychological affective responses

Research in various age groups indicates that SC has a positive effect on both negative and positive affect following a stress induction. Similar to studies regarding the effects of SC on psychopathology, the distinction is made between trained, trait and induced SC. Moreover, most studies utilize adult participants, and indicate that higher levels of trait SC or trained SC are associated with reduced negative affect and increased positive affect following exposure to a stressor (e.g. Leary et al., 2007; Tracy et al., 2021; Kirschner et al., 2019). Regarding induced SC, studies on university students with depressive symptoms reveal an association with more positive affect and less negative affect during induction (Tracy et al., 2021; Ehret et al., 2018; Diedrich et al., 2016; Diedrich et al., 2014). Nevertheless, this effect seems to disappear during post recovery (Tracy et al., 2021).

Despite these important findings, few studies examine trait or trained SC among adolescents. Among the few, similar results are found as those in adults: higher levels of trait SC are tied to experiencing less negative affect, more positive affect, less stress, and greater emotional well-being (Bluth et al., 2016; Marsh et al., 2018). Next, trained SC seems to be associated with increased positive affect, decreased negative affect, reductions in perceived stress and increased life satisfaction (Galla, 2016; Bluth and Eisenlohr-Moul, 2017). However, some studies found no evidence for these beneficial effects of a SC training in youth (Volkaert et al., 2022). Finally, to the best of our knowledge, no studies have investigated the effects of induced SC in adolescents.

Physiological responses

Interestingly, the strengths of SC are believed to reside primarily in its influence on physiological stress systems, particularly on the activity of the autonomic nervous system (Porges, 2011). When confronted with a stressful situation, the human response is driven by two systems:

the sympathetic nervous system (SNS), and the parasympathetic nervous system (PNS) (Adjei et al., 2019). The SNS is primarily known for driving a generic physiological response to combat stress, better known as our “fight-or-flight” response, which encapsulates the phenomenon of physiological energization to overcome and defend ourselves against threats (Cannon, 1915). The body is rapidly mobilized by changes in various bodily functions such as increased heart rate, elevated blood pressure, and heightened immune system activity. Though this mechanism is crucial for survival, excessive or dysregulated responses from these defense systems have been associated with an increased vulnerability to develop psychopathology (Fanselow, 1994; Goldstein, 1987; Niermann et al., 2017).

Apart from the SNS, the PNS also plays a crucial role when confronted with a stressful situation. It counterbalances these stress responses by exerting inhibitory effects on the SNS and relaxing the body (i.e. slowed heart rate, reduced blood pressure, decreased immune system activity, emptying of the bladder, tear production) (Berntson et al., 1991; Avnon et al., 2004). These PNS responses are linked to adaptive restoration of the body and long-term well-being (Fanselow, 1994; Thayer and Sternberg, 2006; Yaroslavsky et al., 2016). Considering the crucial roles of both nervous systems in managing stressful or emotional events, studies on ER often include physiological measures to investigate the effects of ER strategies or interventions. Additionally, physiological variables are often assumed to be objective measures of psychological processes, especially when these processes are difficult to infer from observable behaviour (Porges, 2007).

The exploration of the relationship between physiology and psychological processes is a relatively recent development, that has been facilitated by the emergence of integrative theories linking central nervous system structures to autonomic function over the past four decades (Porges, 2007). One notable theory in this regard is the Polyvagal Theory (Porges, 1995), which introduced

a new perspective relating autonomic function to behaviour, emotions and social interactions (Porges, 2007). The theory proposes that the evolution of the mammalian autonomic nervous system establishes the neurophysiological foundations for adaptive behavioural strategies, and emphasizes the role of the vagus nerve, a key component of the PNS (Porges, 2009). According to this theory (Porges, 1995, 1997, 1998, 2001, 2003), the autonomic nervous system consists of three interconnected, hierarchically organized components ((i) myelinated vagus, (ii) sympathetic-adrenal system, (iii) unmyelinated vagus), each one associated with a distinct autonomic circuit or subsystem. They provide adaptive responses to safe, dangerous, or life threatening events and contexts. Importantly, the myelinated vagus (associated with the PNS) functions as an active 'vagal brake' (Porges et al., 1996): by quickly inhibiting or disinhibiting sympathetic activation, an individual can be rapidly mobilized or calmed, allowing them to swiftly engage and disengage with objects and other individuals and to promote the regulation and modulation of physiological and emotional responses. Deficits in the regulation of this mechanism may contribute to impairments in the regulation of these responses, and in social communication (Porges et al., 1996, 2001, 2009).

Furthermore, Porges' Polyvagal Theory proposes a possible physiological measure to explore ER, the main interest of this paper (Porges, 1995, 2009; Van Beveren et al., 2019). His theory states that individual differences in physiological parameters, particularly those related to the myelinated vagus, which is part of the PNS, can serve as a reliable indicator of emotional reactivity, regulation and even psychopathology. Respiratory Sinus Arrhythmia (RSA), which refers to periodic fluctuations in heart rate associated with breathing, is influenced by the parasympathetic branch of the autonomic nervous system, and operates through one branch of the vagus nerve (Porges et al., 1994). This cyclic pattern of the heart rate occurs due to increases in inhibitory parasympathetic efference during exhalation, and decreases in inhibitory parasympathetic efference

during inhalation (Porges, 1995, 2009; Bauchaine, 2001). RSA is an important construct to examine, as RSA reduction is suggested to facilitate an individuals' ability to cope with stress (Porges, 2007). Taking this into account, RSA is typically highest during periods of rest, decreases rapidly in times of stress, and then increases to facilitate autonomic recovery (Kreibig, 2010). Notably, the myelinated vagus helps facilitate RSA by promoting PNS influence on the heart, resulting in a higher degree of heart rate fluctuations associated with respiration (Porges, 2007). RSA is thought to be a valid and reliable biomarker of ER in humans, and can be studied in three ways: (i) by looking at resting RSA, (ii) by studying RSA reactivity and (iii) by investigating RSA recovery.

Resting RSA refers to the baseline level of RSA, and is thought to reflect the individual's autonomic nervous system's inherent self-regulatory capacity (e.g. Beauchaine, 2001; Hinnant and El-Sheikh, 2009; Price and Crowell, 2016). Across adult and adolescent age groups, lower levels of resting RSA are associated with numerous psychiatric disorders characterized by ER difficulties and symptoms of both internalizing and externalizing psychopathology (Beauchaine, 2012; Vasilev et al., 2009; Bauchaine, 2015). Next, RSA reactivity pertains to the dynamic changes in RSA in response to emotional stimuli or challenges, providing insights into the individual's ability to flexibly regulate their physiological responses to emotional or stressful experiences (Bonanno and Burton, 2013; Gentzler et al., 2009). Interestingly, adaptive ER strategies have been associated with moderate RSA decreases, while excessive RSA reactivity has been linked to maladaptive ER strategies, unsuccessful ER, and emotional lability. These findings are consistent with observations of individuals with poor ER abilities, such as those experiencing internalizing and externalizing psychopathologies, who tend to exhibit excessive RSA reactivity and/or low resting RSA (Beauchaine, 2015). Finally, RSA recovery refers to the speed and efficiency with which RSA returns to baseline levels following an emotional stimuli or stress-related event (e.g. Santucci et al.,

2008). According to the 'vagal brake' mechanism described in Porges' (1995, 2009) Polyvagal Theory, parasympathetic activity is withdrawn once individuals have to respond to a challenge, thereby allowing the heart rate to increase and the individual to adaptively adjust to environmental demands. After the stressor diminishes, individuals are expected to exhibit vagal recovery, indicated by the return of RSA to its baseline level (Gentzler et al., 2009).

Throughout the ER literature, studies investigating the effects of trait, trained or induced SC on RSA are lacking, and the limited studies available yield mixed findings. In adults, trained SC seems to be associated with more adaptive RSA patterns (Arch et al., 2014). Next, regarding trait SC, studies on university students found adaptive RSA patterns for participants high in trait SC (Luo et al., 2018; Svendsen et al., 2016). Finally, some studies found no significant effects of induced SC on baseline RSA or RSA recovery (Maeda, 2022; Tracy et al., 2021), but work by Kirschner et al. (2019) investigating the impact of induced SC revealed adaptive RSA patterns in university students.

In adolescents, no meaningful differences in RSA were found for adolescents with high compared to low trait SC (Bluth et al., 2016). Next, a study by Volkaert et al. (2022) revealed no significant differences in psychophysiology between the group that received a SC training and the control group. Research investigating the effects of induced SC in adolescents are lacking.

Study rationale

In summary, adolescence is a challenging and stressful period characterized by considerable physical, social and emotional changes, often accompanied by increased and more intense negative emotional experiences (De Veld et al., 2012; Spear, 2009). In addition, youngsters seem to be particularly susceptible to the impact of this stress, with the period of adolescence being a critical period for the emergence of stress-related disorders, such as anxiety and depression (Andersen and

Teicher, 2008; Polanczyk et al., 2015). These disorders show a marked increase in prevalence during this transitional phase (Dahl and Gunnar, 2009; Lee et al., 2014; McCormick and Green, 2013; Patton and Viner, 2007) and can serve as an important predictor for psychopathology in later stages of life, given that approximately one in five adolescents develop a persistent mental illness that extends into adulthood (Paus et al., 2008).

One important mechanism that helps adolescents deal with various stressors and intense negative affect is ER (Gross, 1998). Moreover, ER is considered a transdiagnostic factor because it is involved in the onset and maintenance of various forms of psychopathology (Cludius et al., 2020; Fernandez et al., 2016). Therefore, interventions can be developed that address adaptive ER strategies or ER skills in order to target underlying mechanisms across multiple disorders rather than only focusing on disorder-specific symptoms (e.g. Aldao et al., 2010; Buckholtz and Meyer-Lindenberg, 2012). One possible adaptive ER strategy or skill to target is SC. Since SC seems to be associated with higher levels of well-being and lower levels of psychopathology, SC could be proposed as a promising construct to focus on (Gilbert and Procter, 2006; Neff, 2003).

However, The current SC literature is still lacking in a few respects. First of all, the vast majority of studies on SC are conducted using an adult sample. However, more and more studies on SC in adolescents are being published, with the meta-analysis by Marsh et al. (2018) providing a clear overview and revealing that the findings of studies in youth replicate those found in adult samples regarding the effect of SC on psychopathology and psychological affective responses. Nonetheless, this study aims to extend the literature on SC in adolescents given that adolescents are particularly vulnerable for developing psychopathology and ER difficulties.

Secondly, only a limited amount of studies investigates the impact of a SC intervention in adolescents (Volkaert et al., 2022; Bluth and Eisenlohr-Moul, 2017; Bluth et al., 2016). The present

study aims to contribute to the existing literature by examining the effects of a short SC training in adolescents. Additionally, this study explores the dual role of SC, by not only examining the impact of the SC training, but by investigating the role of SC as an independent ER strategy in itself (after applying a stressor) as well. Through this approach, we aim to deepen our comprehension on the ongoing debate considering whether SC should be seen as an adaptive ER strategy, or a facilitator for other adaptive ER strategies. It will also be interesting to explore whether a short intervention at school would promote the application of SC when adolescents are instructed to do so.

Finally, the results regarding the effect of SC on the physiology (RSA) are strongly mixed. Some studies (mostly in adults) reveal evidence for positive effects of SC (e.g. Arch et al., 2014; Luo et al., 2018), whereas others seem to indicate the opposite (e.g. Bluth et al., 2016; Maeda, 2022). The current study will add to the literature by investigating the effects of SC on RSA in adolescents.

Scientific research objectives and hypotheses

The main objective of the current research paper is to examine the effect of trained SC on both physiological (RSA) and psychological affective responses to a stressor in adolescents, as measured by visual analogue scales (VAS). Two conditions will be compared: a SC condition and a control condition. Participants in the SC condition will have received a training about SC beforehand, whereas adolescents in the control condition will have participated in a self-care training. SC will be investigated as an adaptive ER strategy on its own, as well as a facilitator for the use of adaptive ER.

Similar effects are expected as in previous research on adaptive ER strategies: the SC group will show more positive affect and less negative affect compared to the control group. Regarding the physiology, the SC group is expected to show more moderate RSA decreases when confronted

with a stressor compared to the control group, and their RSA is expected to return faster to the baseline compared to the participants who did not follow the training.

Furthermore, the interaction between physiological and psychological affective measures will be considered. People with lower resting RSA at baseline and longer RSA recovery are expected to benefit more from the SC training, resulting in more positive affect and less negative affect than people with a higher resting RSA at baseline.

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