

The effects of stress and anxiety on memory, self-efficacy, and impulsivity among adolescents ages 13-17

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Stress and anxiety are key mental factors that are a part of the brain's extensive network. Caused by the hormone cortisol, stress and anxiety can bring detrimental effects to other aspects of the mind. Previous literature has identified a correlation between adult stress and anxiety, low self-esteem, a loss in the ability to retain memories, and impulsive decision-making. Adolescents, ages thirteen to seventeen years old, have not been investigated due to the shortened duration of human adolescence. However, this adolescent time frame plays a crucial role in the developmental stages of the mind. Self-efficacy inductions of positive, negative, and neutral emotions were used as an indicator of the functionality of memory and impulsivity. The survey-based analysis was used through the combination of episodic memory tasks and compared to the induced emotional states. This research investigated past and present memories that involved stressful situations that prompted a teenager to change their behavior and ability to properly complete described tasks. Results suggest that during adolescence, memory retention is higher when positive self-efficacy was utilized, in comparison to the low self-efficacy induction. Impulsivity was relatively the same throughout each self-efficacy group. The high self-efficacy group scored higher ($m=18.1429$) in comparison to the low ($m=8.4286$) and neutral ($m=13.3571$) inductions. Significant results for positive self-efficacy caused a higher ability to retain memories and be descriptive ($p=0.01912$). Further research should explore the integration of positive self-efficacy in episodic memory exercises to improve brain functionality, memory retention, and impulsivity.

Emotion regulation is defined broadly as the capacity to manage one's own emotional responses. This includes strategies to increase, maintain, or decrease the intensity, duration, and trajectory of positive and negative emotions. Learning to regulate emotions is a key socio-emotional skill that allows flexibility in emotionally-evocative situations. There are clear developmental shifts in how we manage emotional responses. In early childhood, emotions are frequently expressed and external support is sought.

Adolescence is a period of heightened risk for the onset of anxiety disorders and depression. It is well-established that stressful life events and childhood adversity are substantial risk factors for future psychopathology. There is also evidence suggesting that the capacity to regulate emotional reactions to these events may play a mediating role.

Given increased independence and novel demands during adolescence relative to childhood, adolescents may have a

particular need to regulate their emotions in response to stressors. Failure to do so may confer risk for mental health problems. Thus, emotion regulation may be one important piece of a complex puzzle in terms of risk for anxiety and depression. A major challenge in the study of emotion regulation is definition and operationalization of the construct. In this review, we focus on evidence from the most widely-used measures of emotion regulation, rather than providing an exhaustive list of all possible measures. We begin with an overview of methodological approaches to studying emotion regulation most frequently used in adolescents. We then review evidence across levels of analysis supporting claims of a link between negative and positive emotion regulation capacities with anxiety and depression.

A widely used self-report measure is the Emotion Regulation Questionnaire (ERQ) that follows the organizational principles of the process model of emotion regulation and has subscales for reappraisal and expressive suppression. Other questionnaires assess different combinations of emotion regulation strategies, such as the Difficulties in Emotion Regulation Scale the Cognitive Emotion Regulation Questionnaire and the Fragebogen zur Erhebung der Emotionsregulation bei Kindern und Jugendlichen. The varying content of these widely used self-report measures highlights inconsistencies with which the term 'emotion regulation' is used and limits the extent to which data across studies can be combined.

Computer-based methods of assessing emotion regulation behaviors involve presenting participants with affectively evocative images (such as from the International Affective Picture System and asking them to rate the strength of their emotional reaction. In some variants, participants passively view images to assess 'automatic' or 'spontaneous' regulation, other variants aim to enhance ecological validity by swapping affective images for descriptions of ambiguous situations. While providing a degree of experimental control unavailable in observational studies, these 'spontaneous regulation' paradigms still cannot dissociate emotional reactivity from regulation, conflating assessment of the strength of an emotional response with the ability to regulate this response. Neuroimaging studies using functional Magnetic Resonance Imaging (fMRI) to investigate neural correlates of emotion regulation have primarily used deliberate regulation paradigms. Across studies to date, instructions for regulation vary from broad approaches. Emotion regulation has also been proposed as a mediating variable between a risk factor (e.g., early life



adversity) and the development of psychopathology. Mediator variables hold the potential to identify factors that might be altered through intervention to reduce the risk of psychopathology.

Understanding emotion regulation in adolescents with anxiety and depression is critical for improving the efficacy of existing treatments and informing the development of novel interventions. Promoting adaptive emotion regulation is a central component of most evidence-based psychotherapies for adolescent anxiety and depression, although different skills are emphasized across modalities. In contrast, findings from behavioral studies suggest that anxiety in adolescence may be specifically related to a reduced spontaneous use of reappraisal regulatory strategies. However, given that there are far fewer behavioral than self-report studies in this domain and that behavioral studies have less comprehensively assessed all forms of emotion regulation across different diagnoses, the specificity of this effect may not be as clear as it appears.

There are also some individual difference variables that may be of much value to understanding the development of emotion regulation capacities. These include gender, pubertal status and cognitive abilities. Each of these have been suggested to impact the relationship between emotion regulation and psychopathology and may be of interest in future work. Finally, further work investigating mechanisms of psychological interventions targeting emotion regulation abilities may be a particularly promising approach. This would allow a well-controlled investigation of whether training to enhance cognitive strategies for emotion regulation in adolescents mediates the impact of psychological therapies on symptoms of anxiety and depression.