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Cognitive Bias Modification Approaches for Adolescents with Anxiety

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Cognitive Bias Modification Approaches for Adolescents with Anxiety

by

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Chapter 1: Introduction

Anxiety can be a typical reaction to stress, but for some people who suffer from excessive anxiety it can be debilitating and greatly affect their ability to function effectively on a day-to-day basis (Weir, 2011). Individuals who are highly anxious or who have clinical anxiety disorders characteristically experience irrational fears that some researchers contend are a result of faulty cognitive processing (Brosan, Hoppitt, Shelfer, Sillence, & Mackintosh, 2011). Often referred to as *cognitive distortion*, it describes irrational thoughts and views of oneself or events that can lead to a negative view of the world, low self-esteem, depression, and anxiety.

It is typical for adolescents to experience some level of anxiety. However, when anxiety becomes excessive, it negatively affects students' success at school, home, and community (Mazurek, Kelly, & Lusk, 2014). For example, McLoone, Hudson, and Rapee (2006) found that students with anxiety disorders are at increased risk for illegal drug use and life-long depression. Thus, finding developmentally appropriate interventions for anxiety disorders, that address cognitive distortion, is important to improve adolescent mental health.

Cognitive bias modification (CBM) is a rather recent and modern approach to adjusting cognitive processing deficits that contribute to anxiety disorders (Beard, 2011). CBM interventions are designed to modify an individual's attention to and interpretation of events that create anxiety by having individuals engage in repeated practice on cognitive tasks (Beard, 2011). Because individuals with anxiety automatically focus on negativity, CBM aims to alter those perceptions through computer-based programs (Weir, 2011). The purpose of this starred paper was to determine if CBM is effective in reducing anxiety in adolescents.

Historical Background

Part of being human is to experience emotions, and fear is one of those emotions. Hippocrates may have been the first person to formally recognize anxiety when he coined the term *hysteria* in the 5th century BC (Tasca, Rapetti, Carta, & Fadda, 2012). At that time—and even into the early years of modern psychiatry—the condition of hysteria was commonly considered to be more prevalent in women (Gilman, King, Porter, Rousseau, & Showalter, 1993). In 1900 BC, Papyrus identified the cause of hysterical disorders as spontaneous uterus movement (Tasca et al., 2012). Through the 2nd century AD, physicians continued to view hysteria as a violent disease coming from the womb and treated patients with hellebore, mint, laudanum, belladonna extract, hot baths, massages, and the suggestion of marriage (Tasca et al., 2012).

During the Renaissance era, women with symptoms of hysteria were subjected to exorcism due to the belief that they were witches (Tasca et al., 2012). People with anxiety often worry about events that might happen, and others who knew nothing of such medical conditions might have perceived these worries as premonitions. In the past when physical symptoms could not be explained, they were often attributed to witchcraft and individuals were tortured, executed, or burned at the stake (Gilman et al., 1993). It was not until the end of the 17th century that men began to be diagnosed with conditions in which anxiety was a symptom. Willis, a physician, introduced the idea that hysteria was not solely caused by the movement of the uterus, but related to the brain and the nervous system (Tasca et al., 2012).

Starting in the 18th century and the Victorian era, hysteria began to be classified as neurosis. Although Willis may have been the first to introduce the idea of hysteria shifted to

being associated with the brain. People who became hysterical were considered crazy, and the treatment of choice was electroshock therapy. Jean Martin Charcot, a neurologist, began to study the effectiveness of hypnosis on patients with hysteria (Tasca et al., 2012).

Symptoms of anxiety have always manifested in soldiers who have served in combat. Soldiers from the Civil War were experiencing what we now know as Post Traumatic Stress Disorder (PTSD) and were treated with opium, which created many negative side effects. During World War I and II, soldiers with PTSD were treated with barbiturates. During the post-war era, Rivers explored the psychoanalytic issues of fear and anxiety and concluded that hysteria was caused by a reaction to danger (Gilman et al., 1993).

Diagnostic History of Anxiety Disorders

Anxiety disorders are among the most common of all mental illnesses and are associated with underachievement at school and disruption of social interactions (Lau, 2013). According to the Child Mind Institute (2015), 40.2% of young people 13-18 years old have an anxiety disorder; 8.3% of those children have a severe impairment. Currently, 80% of those diagnosed with an anxiety disorder do not receive treatment (2015), even though treatment has advanced significantly over the past 30 years for adolescents with anxiety disorders.

The first mention of anxiety as a recognized psychiatric symptom was in the *Diagnostic and Statistical Manual of Mental Disorders-First Edition* (DSM-I) published in 1952 by the American Psychiatric Association (APA). The DSM-I was based largely on psychoanalytic theory, and anxiety was described as a symptom of *psychoneurotic disorders* (Tartakovsky, 2011). When the DSM-III was published in 1980, the APA had moved to a more empirical classification system and listed three types of anxiety disorders: separation anxiety disorder,

overanxious disorder, and avoidant disorder. The creation of the new DSM category brought new interest in the research of anxiety disorders in children and adolescents resulting in an increased number of research studies conducted on this topic (Strauss, 1990).

The DSM-IV and DSM-IV-Text Revision (TR) expanded the categories of anxiety disorders affecting children and adolescents. These included generalized anxiety disorder, panic disorder, obsessive-compulsive disorder, posttraumatic stress disorder, acute anxiety disorder, and social anxiety disorder (Tartakovsky, 2011).

The DSM-5, published in 2013, no longer includes obsessive-compulsive disorder or posttraumatic stress disorder among anxiety disorders (American Psychological Association [APA], 2013). These disorders have been identified in other categories. The DSM-5 provides a general definition of anxiety disorders as those that with core symptoms of excessive fear and anxiety and related behavioral disturbances. “*Fear* is the emotional response to real or perceived imminent threat, whereas *anxiety* is anticipation of future threat” (APA, 2013, p. 189). DSM reclassified these, and the diagnostic categories are presented in Table 1. It is noteworthy that none of the Chapter 2 studies relied upon DSM-5 diagnostic criteria; typically, DSM-IV or DSM-IV-TR criteria were used.

Table 1**DSM-5 Anxiety Disorders**

DISORDERS	SYMPTOMS
Separation Anxiety Disorder	Excessive fear or anxiety about separation from a caregiving individual
Social Anxiety Disorder	Excessive fear or anxiety about social situations
Generalized Anxiety Disorder	Excessive anxiety and worry about a number of events or activities including health, family, money, or work. Symptoms include restlessness, being easily fatigued, difficulty concentrating, irritability, muscle tension, and sleep disturbance.
Panic Disorder	Recurrent and unexpected panic attacks, which are sudden and abrupt surges of intense fear and discomfort that peaks within minutes. During the panic attack, the individual experiences symptoms that include heart palpitations, sweating, trembling or shaking, shortness of breath, feeling of choking, nausea, dizziness, and fears of losing control or dying.
Specific Phobia	Uncomfortable and terrifying feelings of anxiety such as a feeling of imminent danger or doom, the need to escape, heart palpitations, sweating, trembling, shortness of breath or a smothering feeling, a feeling of choking, chest pain or discomfort, nausea or abdominal discomfort, feeling faint, a sense of things being unreal, a fear of losing control, a fear of dying, tingling sensation, or chills/hot flashes.
Selective Mutism	Consistent failure to speak in specific social situations despite speaking in other situations. Not speaking interferes with school or work, lasts at least 1 month. Failure to speak is not due to a lack of knowledge of, or comfort with the spoken language required in the social situation, and is not due to a communication disorder. Children may also show anxiety disorder, excessive shyness, fear of social embarrassment, or social isolation/withdrawal.

Treatment for Anxiety Disorders

Modern techniques emerged in the 1950s, and antidepressants were considered an effective treatment along with fear exposure therapy. Fear exposure therapy called for patients to be repeatedly exposed to their fear trigger in order for desensitization to occur (Gilman et al., 1993).

A variety of pharmacological treatments are also available to treat anxiety, although this is beyond the scope of this paper. During the past 2 decades, therapists often combine medication with psychosocial interventions to treat anxiety, particularly cognitive behavior therapies (CBT). Cognitive behavior therapy focuses on identifying, understanding, and

changing thinking and behavior patterns (Clark & Beck, 2010). Cognitive bias modification, one type of cognitive therapy, has recently received increasing attention as an effective anxiety intervention.

Cognitive Approaches

Albert Ellis, a psychologist, and Aaron Beck, a psychiatrist, independently developed two parallel theories that resulted in the formation of CBT (Jacofsky, Santos, Khemlani-Patel, & Neziroglu, 2013). Ellis and Beck found that a person's thoughts, feelings, beliefs, and perceptions influence how they respond to daily stimuli (Strongman, 1995). Cognitive theory is now viewed as an umbrella term for therapies that emphasize the responsibility of the mind's perceptions in determining behavior (Jacofsky et al., 2013).

In the 1950s, Ellis developed Rational Emotive Behavior Therapy (REBT) as one type of a cognitive therapeutic approach. Ellis hypothesized that people's anxiety and suffering was a result of negative emotions caused by their *irrational core beliefs*, or the "basic beliefs people have about themselves and the world around them" (Jacofsky et al., 2013, p. 2). The purpose of REBT is to teach people with these irrational beliefs to think in a more rational balanced manner, which then would eliminate their extreme emotions and dysfunctional behavior (Albert Ellis Institute, 2013).

In the 1960s, Beck developed an approach called Cognitive Therapy, which was known for its effective treatment for depression (National Association of Cognitive-Behavioral Therapists, 2008). Like Ellis, Beck believed behavior is determined by individuals' thoughts about what is happening around them. According to Beck, the way we understand environmental events is a function of our *core schema*, which is "a central assumption about

oneself, others, and the world” (Jacofsky et al., 2013, p. 3). Beck’s cognitive therapy focuses on replacing an individual’s cognitive distortions by examining the rationality and validity of the assumptions behind them, which is termed *cognitive restructuring* (Ford-Martin, n.d.).

CBT interventions have been effective in reducing anxiety symptoms and preventing the onset of anxiety disorders in adolescents in a school setting (McLeod, 2015). Recent research suggests it might be more effective if cognitive biases are targeted directly (Sportel, de Hullu, de Jong, & Nauta, 2013). Cognitive Bias Modification (CBM) was developed as a CBT intervention in the early 2000s to train individuals direct their attention away from threat-related stimuli and to interpret language and behaviors in a more rational manner (Brosan et al., 2011). CBM was also developed due to costs and time commitment of CBT. Because CBM directly targets “anxiety vulnerability,” it purportedly can be used as a preventative intervention for those who are showing warning signs or who are at risk for developing anxiety disorders (de Hullu, 2012, p. 18). CBM was first initiated with adults, but recently is being applied to adolescents.

Cognitive Bias Modification focuses on interpretive or attention biases. Interpretive bias is characterized by interpretation of “ambiguous or mildly negative cues” in a catastrophic manner (Beard, 2011, p. 301). Attention bias is characterized by attending selectively threat stimuli, even when stimuli are” irrelevant to current goals” (Beard, 2011, p. 300). CBT is a lengthy process that requires a trained mental health worker to work with an individual with anxiety over multiple sessions to help him or her become aware of irrational negative thoughts so that the person can respond to them more effectively. CBM interventions are designed to directly modify attention and interpretation biases by repeating cognitive tasks, which is

accomplished mostly on the computer and does not require a trained mental health worker.

CBM is easier to access due to being a computerized approach.

Research Question

One question guided this review of the literature: Are cognitive bias modification approaches effective in reducing anxiety symptoms of adolescents?

Focus of the Paper

To be included in this paper, studies had to be conducted from 2005 through 2015 using DSM-IV or DSM-IV-TR criteria. Studies provided quantitative or qualitative data obtained from educational or clinical settings. Studies included students in middle school or high school from English-speaking countries, who were either diagnosed with an Anxiety Disorder or with anxiety symptoms. When studies also included elementary students or adults, I used only the information related to middle or high school students.

Using the Academic Search Premiere and PsychINFO database I used a number of keywords and combinations of keywords to locate articles on this topic: *cognitive bias modification, anxiety, anxiety disorders, internalizing disorders, and adolescents*. I also reviewed the tables of contents of three different journals: *Behavior Therapy, Experimental Psychiatry and Developmental Cognitive Neuroscience, and Behaviour Research and Therapy*.

Importance/Rationale

Typically, pharmacological interventions are used to treat anxiety in combination with cognitive behavioral therapy. However, given the side effects of some medications and the unknown long-term effects of their use on adolescents, some professionals advocate an approach that relies less on medication and more on educating adolescents how to deal with their anxiety.

At Eden Prairie High School in recent years, more students are qualifying for special education services with a diagnosis of anxiety. Students with high anxiety are unable to attend general education classes, and some have difficulty attending school. As a special educator, it would be helpful for me to be able to implement interventions that are easily delivered, low-intensity, and universally available. Too frequently, these students do not receive the type of help they need until symptoms are too severe to manage at school. Cognitive Bias Modification appears to be the treatment that offers promise for students with anxiety disorders.

Definitions

This section provides definitions for relevant terms used in this paper, unless the terms have already been defined.

Ambiguous scenarios are situations or events that could happen to any person, but could be interpreted or understood differently by individuals.

Cognitive bias is a systematic error in judgment and decision-making common to all human beings, which can be due to cognitive limitations, motivational factors, and/or adaptations to natural environments (Wilke & Mata, 2012).

Cohen's d is a measure of effect size that indicates how large or small a significant difference is using standard deviation units (Gay, Mills, & Airasion, 2006).

Induced bias: persuading or being influenced in favor of one thing compared with another.

Interpretation bias is the tendency to interpret ambiguous situations in a positive or negative fashion (Huppert, Foa, Furr, Filip, & Mathews, 2003).

Q scores refer to the proportion of population elements that *do not* have a particular attribute (Stat Trek, 2016)

Trait anxiety refers to the stable tendency to attend to, experience, and report negative emotions such as fears, worries, and anxiety across many situations and is characterized by a stable perception of environmental stimuli (events, others' statements) as threatening (Gidron, 2013).

Chapter 2: Review of the Literature

Adolescents with anxiety disorders have difficulty functioning successfully at school, home, and in the community (Mazurek Melnyk, Kelly, & Lusk, 2014). In this chapter, I review the literature that examines the effectiveness of Cognitive Bias Modification (CBM) as a treatment for adolescents' anxiety. Two CBM approaches are reviewed: CBM-Interpretive (CBM-I) and CBM-Attention (CBM-A). CBM approaches diminish threat-related cognitive biases by repeated computer-based practice. This practice disengages the individual from threat-related stimuli by using a visual probe task (cognitive bias modification for attention; CBM-A) or by interpreting emotional ambiguity in a positive direction (cognitive bias modification for interpretation; CBM-I).

CBM-I Studies

One type of CBM is identified as CBM-I. Interpretive biases validate less threatening rather than negative resolutions of ambiguous scenarios. By modifying these biases through training, anxiety symptoms may be reduced. Seven studies are included in this section.

Lau, Molyneaux, Telman, and Belli (2011) investigated whether a computerized cognitive training package designed for adolescents was effective for generating positive and negative interpretations of ambiguous information. They also assessed whether these induced biases altered mood change. The study included 39 adolescents' ages 13-18 years recruited from schools in Oxfordshire and Buckinghamshire. Participants were excluded if they had a current diagnosis of a mood or anxiety disorder. They were randomly assigned to either the positive or negative CBM-I training group. Seventeen students were assigned to the positive training group, and 19 were assigned to the negative training group.

Participants were not informed of the purpose of the training program but were debriefed at the end of the study. Participants in the two groups were exposed to scenarios that were resolved in either a positive or negative direction. The CBM-I training included scenarios that were relevant to adolescents (e.g., social relationships, school, and extracurricular pursuits). The training task consisted of one practice trial following 60 recorded trials of everyday scenarios that remained emotionally ambiguous until the final word, which was presented as a word fragment on the following screen. Participants identified the word from the fragment as quickly as possible and then responded to a comprehension question. The correct answer was based upon whether they were assigned to the positive or negative training group.

After CBM-I training, participants completed a two-part test of induced bias on a laptop computer with E-Prime 2.0. During the first phase, no positive or negative meanings/results were assigned to the word fragments or comprehension questions. During the second phase, they were presented the title of each scenario they viewed, followed by four statements relating to the scenario to rate similarities. Bias induction was successful if the negative CBM-I training group rated negative targets as more similar to the original ambiguous scenarios and if the positive CBM-I training group rated positive targets as more similar.

Throughout the study, participants' mood was assessed four different times using the *Positive and Negative Affect Scale for Children* (PANAS-C; Laurent et al., 1999). The negative emotions included *nervous, sad, upset, worried, anxious, miserable, scared, and gloomy*. The positive emotions included *happy, calm, cheerful, and energetic*. Participants also completed the Trait scale of both the *State Trait Anxiety Inventory for Children* (STAI-C; Spielberger, 1973) and the *Self-Efficacy Questionnaire for Children* (SEQ-C; Muris, 2001). Independent sample

t-tests and 2 x 2 x 2 ANOVAs were conducted to analyze data, and effect sizes were estimated using Cohen's *d*.

The results showed adolescents who were assigned to receive positive training drew more positive interpretations of new ambiguous information than those who received negative training. Results showed no training effects on word fragments or comprehension question completion. The ratings of positive targets who received training (PT) rated were significantly more similar to the original than negative targets (NT) ($t_{(16)} = -2.47, p = .025$; PT mean = 2.62, NT mean = 2.23, $d = .76$). Participants who received negative training gave higher similarity ratings to NT than PT ($t_{(18)} = 2.69, p = 0.15$; NT mean = 2.77, PT mean = 2.25, $d = .97$). Positively-trained individuals gave higher recognition ratings to positive foils (PF) than negative foils (NF) ($t_{(16)} = -3.11, p = .015$; PF Mean = 2.23, NF Mean = 1.90). Negatively trained adolescents showed a trend for rating NF as more similar to the original scenarios than PF (PF Mean = 1.97, NF Mean = 2.10). The significant 3-way interaction between time, training group, and self-efficacy ($F_{(1,31)} = 4.76, p = .037$) indicated reductions in positive mood following negative training only characterized adolescents with low self-efficacy.

Adolescents who were assigned to the positive training drew more positive interpretations of new ambiguous information than those who received negative training. Reductions in positive mood following negative training only characterized adolescents with low self-efficacy. The researchers concluded these data support CBM-I's potential as a new tool in clinical settings used as a part of early treatment or prevention efforts with adolescents with anxiety.

Telman, Holmes, and Lau (2013) conducted a similar study to investigate whether positive versus negative CBM-I training influenced appraisals of stress. The study included 46 adolescents from 15-18 years old who attended secondary schools around Oxfordshire. Participants were excluded if they had a past or present diagnosis of a mood or anxiety disorder. Adolescents were randomly assigned to either positive CBM-I or negative CBM-I training, but were not informed of the purpose of the bias modification paradigm until after the study.

Like the Lau et al. (2011) study, participants were assessed using the STAI-T-C. In contrast to the Lau et al. study, Telman et al. (2013) used the *Assessment of CBM-I Training Effects on Appraisals of Recent Stressors* to assess appraisals of events in terms of perceived impact, coping, and controllability. Participants also completed a life events scale developed with 15 items from the *Adolescent Perceived Events Scale* (Compas, Davis, Forsythe, & Wagner, 1987) and the *Child Life Events Checklist* (Johnson & McCutcheon, 1980) to reflect several domains of stress: *family relationships, peer relationships, academic achievements, and uncertainty about the future*. If a situation had occurred in participants' lives during the past 6 months, they answered questions about *impact, coping, and control* of the event.

This study provided clear support that negative and positive interpretation biases can be induced in adolescents by current computerized training methods. Differential training effects emerged: negative CBM-I training predicted increases in negative affect across participants ($t_{(22)} = 2.51, p < .04, d = .42$), whereas positively trained individuals showed no change. Negative and positive CBM-I training also differentially and significantly changed assessments of recent stressors. Positively trained adolescents rated stressors as having significantly less

impact ($t_{(41)} = 2.23, p < .05, d = .69$). Trait anxiety significantly influenced ratings of impact ($F_{(1,39)} = 6.89, p < .05$); coping ($F_{(1,39)} = 9.40, p < .01$); and controllability ($F_{(1,39)} = 13.03, p < .01$). Those with high-trait anxiety perceived events as having more impact, and low-trait groups were less able to cope with events. The researchers noted that they did not include baseline measures of interpretation bias.

The Telman et al. (2013) findings contribute to the evidence that suggests the plasticity of cognitive biases in youth. They found cognitive biases could be changed through a computerized program involving repeated exposure to the reinforced positive and negative resolution of imagined ambiguous situations.

Vassilopoulos, Banerjee, and Prantzalou (2009) conducted a study with 10- and 11-year-old students identified with high social anxiety from three regular primary schools in Greece. Forty-three students were randomly assigned to three sessions of interpretation training over a 2-week period or to a test-retest control situation. The CBM-I training focused on endorsing benign rather than negative interpretations of potentially threatening social scenarios.

Pretest measures included the *Social Anxiety Scale for Children-Revised* (SASC-R; La Greca & Stone, 1993), the *Children's Depression Inventory* (CDI; Kovacs, 1992), an initial interpretation bias test, and an anticipated social interaction test, which assessed whether manipulating children's interpretations in children influenced anticipated anxiety and predicted outcomes for an upcoming social situation. The experimenter visited those students assigned to the interpretation-training group three times over 7 days. After the third and final training session, all tests were re-administered. Participants assigned to the control condition were also visited after 3 weeks and completed the same tests.

ANOVAs revealed a main effect of time ($F_{(1,41)} = 10.58, p < .001$), qualified by a significant interaction of time with group ($F_{(1,41)} = 4.96, p < .05$), which was consistent with the researchers' hypothesis that negative interpretation would decrease following training and when compared to the control condition. Post hoc comparisons showed a significant reduction in negative interpretation ratings after training ($p < .001$), but no significant reduction in ratings for the control group that did not receive the training ($p > .10$). A significant interaction of time was reported for social anxiety symptoms following interpretation training compared to the control condition ($F_{(1,41)} = 17.32, p < .001, F_{(1,41)} = 24.81, p < .001$), which was consistent with the researchers hypothesis of a greater reduction in social anxiety symptoms following interpretation training as compared to the control condition. When given the anticipation test, children who received the interpretation training reported they would be significantly less anxious in an upcoming social situation compared to those in the control group, although differences were not significant. A correlation analysis showed changes in social anxiety were significantly correlated with changes in negative interpretation ratings ($r_{(43)} = .34, p < .05$), such that reduction in social anxiety was associated with a decrease in negative interpretation ratings.

Vassilopoulos et al. (2009) showed that interpretations of ambiguous social situations in a sample of high socially anxious children can be successfully positively modified. They concluded this training had a beneficial effect on important aspects of social anxiety. The study's findings are limited because participants' behavior during the training sessions was not monitored. It is also important to note that the length of time of the study was particularly short and it would be necessary to examine anxiety symptoms over a longer period of time to see the benefits of CBM-I. Also, it is to be noted that although researchers found training had influence

on adolescents' anxiety, it is unknown if they would be able to generalize what was learned in an actual stressful situation.

Vassilopoulos, Blackwell, Moberly, and Karahaliou (2011) replicated and extended the findings of their 2009 CBM-I study with 94 primary school children from Greece. All of the children ranged in age from 10-12 years and were diagnosed with high social anxiety. Participants were administered the SASC-R, CDI, *Discounting of Positive Events Scale for Children* (DPESC; Vassilopoulos et al., 2011), and measures of interpretation and judgmental biases. The students were then randomly assigned to either the imagery instructions or verbal instructions condition.

The researchers used a procedure similar to that described by Vassilopoulos et al. (2009) for the interpretation-training program. In order to focus participants on their assigned task, after each description they rated their ability to engage in self-imagery or ability to comprehend the description depending on condition (imagery vs. verbal). In the imagery instructions condition, participants were given a non-emotional example description printed on a card together with instructions to imagine themselves in the situation and then were asked to describe their mental image out loud. In the verbal instructions condition, participants were instructed to focus on the meaning of the description as they read it. Again, they were asked to rate their ability to engage in self-imagery or comprehension. After the sessions were completed, all tests were re-administered.

Changes in interpretation ratings were examined using a mixed ANOVA with a between-subjects factor. A significant main effect of time was reported for negative interpretation ratings ($F_{(1,92)} = 39.62, p < .001$), qualified by a significant interaction of time by condition ($F_{(1,92)} =$

4.12, $p < .05$). This means participants tended to make more benign interpretations at post-training than at pre-training. Analysis of change scores showed significantly greater reductions in negative interpretation ratings following training in the verbal instructions condition ($M = .77$, $SD = .82$) than in the imagery instructions condition ($M = .39$, $SD = .96$, $t_{(92)} = 2.03$, $p < .05$). Changes in estimates of negative emotional consequences of the hypothetical social events from pre-training to post-training revealed a significant main effect of time ($F_{(1,92)} = 56.00$, $p < .001$), qualified by a significant interaction of time by condition ($F_{(1,92)} = 12.44$, $p = .001$).

Tests of simple effects showed a significant reduction in social anxiety scores from pre-training to post-training in the verbal condition ($F_{(1,45)} = 4.76$, $p = .03$), but not in the imagery condition. When discounting positive events were tested, researchers found a significant main effect of time ($F_{(1,92)} = 4.78$, $p = .03$), reflecting a general decrease in the discounting of positive events from pre-training to post-training, but no significant main effect of condition.

This replication study supported the findings of the previous Vassilopoulos et al. (2009) study by showing it is possible to modify interpretation and judgmental biases in children using a text-based interpretation-training paradigm. Compared to pre-training assessments, participants trained to make benign interpretations in both imagery and verbal instruction conditions, interpreted ambiguous events less negatively, and anticipated less negative consequences of these events. They also found that instructions to focus on the verbal meaning of the descriptions led to significantly greater decreases in negative interpretation and judgmental biases than instructions to imagine the same events. These findings suggest that interpretation training in children can be effective with verbal instructions and highlight the need to further

investigate how to optimize the effectiveness. The study was limited by its reliance on responses to hypothetical situations and its exclusive reliance on self-report.

Lester, Field, and Muris (2010) addressed the limitations of previous studies by:

(a) training biases about a wider range of real situations (animals and social situations), (b) assessing the effects of acquired biases using a real ambiguous situation, and (c) determining how the effects of particular threats varied by age. Participants included 103 children aged between 7-15 years of age from two primary schools and two secondary schools in the United Kingdom. They were randomly assigned to one of four bias modification conditions: positive animal modification, negative animal modification, positive social modification, and negative social modification.

Each child completed the STAI-C and the *Fear Survey Schedule for Children-Revised* (FSSC-R, Ollendick, 1983) which measures trait anxiety and a broad picture of children's fearfulness of various stimuli and situations. Participants were then introduced to the interpretation bias modification paradigm, which was modified from Muris, Huijding, Mayer, & Hameetman (2008) paradigm to present ambiguous animal or social fear situations and was programmed in E-Prime 1.2. Children also completed the baseline version of the ambiguous vignettes paradigm, which measured interpretation bias about animal or social situations by indicating how nervous they felt "right now" using a visual analogue mood scale (Lester et al., 2010, p. 699). The bias modification phase was then administered and included 30 ambiguous scenarios in a random order. Immediately after, children completed a second visual analogue mood scale assessing how nervous they felt. The final testing phase then followed, and participants completed a parallel version of the ambiguous vignettes paradigm. Participants

continued by completing the behavior avoidance task, which was administered to assess the effect of interpretation bias modification on behavioral avoidance tendencies and finally were debriefed by completing a short positive bias modification phase, consisting of 10 ambiguous vignettes relating to either social or animal situations.

The effect of bias modification on interpretation bias was significant for both modification groups ($p = .02$). Change scores for positive and negative modification conditions differed significantly for animal modification ($p = .002$, $d = 1.26$). Children learned rapidly to select outcomes of ambiguous situations that aligned with their assigned modification condition. Following positive modification, children's threat interpretation biases significantly decreased, whereas threat biases increased somewhat after negative modification but did not reach significance. Bias modification effects also varied according to age, and children appeared to acquire biases that fell within the range of "normative fears for their age group" (Lester et al., 2010, p. 697). Anxiety changes were significantly greater following social modification compared to animal modification ($M = 31.42$ versus 19.23).

The findings provide preliminary support for the notion that interpretation biases can be modified in children using experimental CBM procedures. Although the expected group differences in threat interpretation bias were observed, further analyses revealed the change in threat bias was significant only following positive modification. The findings also began to reveal possible developmental patterns in anxiety-related cognitions, which should be explored in future studies.

Lester, Field, and Muris (2011) investigated the effects of experimentally modifying interpretation biases for children's cognitions, avoidance behavior, and anxiety vulnerability.

Sixty-seven children between 6-11 years from primary schools in the United Kingdom were randomly assigned to receive positive animal modification or negative animal modification. The researchers followed the same procedure as their 2010 study.

To determine whether children learned to consistently select the negative or positive outcomes during the modification phase, children's responses were divided into three blocks of 10 trials. The main effect of blocks was significant. Planned comparisons showed that the number of correct responses significantly increased from Block 1 to Block 2 ($t_{(66)} = -7.27$, $p = .001$). Interpretation bias scores decreased across time and overall, bias scores were higher in the negative compared to positive condition. Consistent with the hypothesis, threat biases decreased significantly across positive modification ($t_{(33)} = 5.61$, $p < .001$), but increased significantly across negative modification ($t_{(31)} = -2.98$, $p = .006$). These findings indicate that children interpreted new ambiguous situations in a manner congruent with their assigned modification condition. That is, threat biases decreased significantly following positive modification, and threat biases increased significantly following negative modification. The pre-post effect sizes for the change in interpretation bias were medium to large for positive ($d = 1.01$) and negative modification ($d = 0.53$), which were comparable to the previous Lester et al. (2010) study.

The present findings show that interpretation biases can be learned and successfully modified in children using experimental cognitive bias modification procedures. Lester et al. (2011) concluded that children develop biases toward threat as a result of consistent reinforcement and cues and that bias modification sessions can reduce threat interpretations and

thereby reduce social and trait anxiety. However, the lack of a control group limits the generalizability of findings.

Salemink and Wiers (2011) examined whether the CBM-I procedures used with adults produced similar outcomes for adolescents. Specifically, this study examined whether CBM-I can modify threat-related interpretations in adolescents and if modified interpretive bias can be generalized to a new task containing new stimuli. In addition, the researchers examined the effects of CBM-I on state anxiety and what factors might influence CBM-I effects. The 144 participants ranged in age from 14-16 years and were born in the Netherlands. They were randomly allocated to either the positive CBM-I or the placebo control condition. For ethical reasons, the positive training condition was not compared to a negative training condition.

Prior to training, the computer-program presented the STAI-C trait and state questionnaires. Participants then completed the first recognition task, which assessed generalization of modified interpretive bias to a new task containing new scenarios. Participants were then randomly assigned to either the positive CBM-I condition or the placebo-control condition. After CBM-I, participants completed the STAI-C for the second time and completed the second recognition task. At the end of testing, participants were debriefed. The session took approximately 45 minutes.

The researchers examined the relationship between interpretive bias, anxiety, gender, and age using correlation analyses. Results indicated that interpretive bias scores were positively associated with trait and state anxiety. Consistent with previous findings; higher levels of anxiety were associated with a stronger treat-related interpretive bias. Gender was also significantly correlated with trait and state anxiety, showing females reported more state and trait

anxious feelings. The effects of CBM-I on interpretive bias did not differ significantly in the percentage of incorrect responses to probe word fragments or comprehension questions. Direct comparison of the two conditions revealed that adolescents trained to interpret information positively were significantly faster to complete positive probes compared to individuals who followed the placebo-control training ($t_{(150)} = 2.6, p = 0.01, d = 0.4$).

The cognitive bias modification procedure was effective in modifying interpretations of ambiguous social situations. After training, groups differed significantly in their positive interpretations ($t_{(137)} = -2.5, p = 0.01, d = 0.4$) and in their negative interpretations ($t_{(137)} = 4.6, p < 0.001, d = 0.8$). That is, positively trained adolescents interpreted new ambiguous information more positively and less negatively than adolescents in the placebo control condition.

The impact of CBM-I on change in state anxiety revealed a significant main effect of gender ($F_{(1, 143)} = 5.7, p = 0.02$) and age, ($F_{(1,143)} = 4.7, p = 0.03$). These findings reflected relatively high levels of state anxiety for girls compared to boys. Even though participants ranged in age from 14-16, the younger students' had higher levels of state anxiety.

The results of this study showed that adolescents trained to interpret information more positively were significantly quicker in solving positive solutions of ambiguity than adolescents in the placebo-control condition. The absence of CBM-I effects on state anxiety may be related to the fact that state anxiety was assessed with the STAI-C questionnaire, which is a general measure and the training does not match the content of the questionnaire.

CBM-A Studies

The CBM intervention that focuses more on attention bias is CBM-A. Attention biases are described as things one notices subconsciously and automatically. Over time, the hope is to alter the bias in order to reduce anxiety. There are two studies in this section.

Krain Roy et al. (2008) examined attention bias towards “threat faces” in youth with anxiety-disorders using a cognitive-behavioral approach. The study included 101 children and adolescents from 7-18 years of age who were clinically anxious. Fifty-one healthy, non-anxious, participants from 9-18 years of age were also recruited through advertising and ongoing studies through National Institutes of Mental Health and the NYU Child Study Center. The anxious group was a great deal younger than the healthy group and had a greater ratio of White to non-White participants. The full-scale IQ scores were also significantly lower in the anxious group along with slower psychomotor performance. Due to the groups differing on several descriptive variables, Krain Roy et al. examined the association between these measures and both happy and threat bias.

The participants were administered a computerized visual probe task that presents pairs of faces portraying threat, positive, and neutral expressions. Using EPrime software, the participants were prompted to indicate as quickly and accurately as possible whether the probe appeared on the right or left of the keyboard after two photographs appeared displaying a positive, threat, or neutral expression. Attention bias scores were then calculated from response times to probes for each emotional face type. Chi square tests and independent sample t-tests were used to examine group differences in age, gender, race, socioeconomic status (SES).

T-tests, ANCOVAs, Pearson correlations, and linear regression formulas were used to examine group differences and correlations in bias scores and clinical anxiety variables.

The results showed anxious participants demonstrated a greater attention bias toward threat faces, but no difference toward happy faces. When group differences in bias scores for threat faces were compared, the data showed significantly greater threat bias scores in the anxious group ($M = 10.7$, $SD = 38.6$) compared to healthy youths ($M = -7.96$, $SD = 31.4$) ($t_{(150)} = 2.98$, $p = .003$). The mean threat bias score in anxious participants indicated bias toward threat ($t_{(97)} = 2.52$, $p = .01$) compared to no bias in the healthy group. ANCOVAs that controlled for the differences in age, race, IQ, and mean RT between groups produced significant differences between groups ($F_{(1,145)} = 3.96$, $p = .049$).

Data from clinical measures and individual anxiety disorders showed no association between threat bias and anxiety severity, specific anxiety diagnoses, or number of anxiety diagnoses. When group differences in bias scores for happy faces were compared, the data showed no significant differences between anxious and healthy groups after controlling for age. Data from clinical measures and individual anxiety disorders showed no correlation between happy bias scores and anxiety, anxiety diagnoses, or number of anxiety diagnoses. Due to the groups differing on several descriptive variables, Krain Roy et al. examined the association between those measure and both happy and threat bias.

These results suggest pediatric anxiety disorders are associated with an attention bias toward threat. The current findings should be evaluated in light of study limitations due to environmental conditions could not be controlled across the seven study sites even though no site differences were found. The anxious and healthy groups were not matched on age, race, IQ, or

RT during neutral trials and after controlling for those variables, the group differences in threat bias remained, although at a lower statistical threshold. Overall, the study provides support for the relationship between pediatric anxiety and attention bias toward threat.

Waters, Pittaway, Mogg, Bradley, and Pine (2012) examined the efficacy of an attention bias modification training (ABMT) protocol with 37 clinically anxious children ages 7-13. Eighteen were randomly assigned to attention-toward-positive condition (ATP) and 19 to attention-training-control condition (ATC). In the ATP condition, children searched 3 x 3 matrices for a happy face among angry faces, whereas the participants in the ATC condition searched for a bird among flowers.

An initial telephone-screening interview that addressed inclusion/exclusion criteria was conducted with parents of the children who were referred. The parents were informed the study would consist of two phases: (a) an initial, at-home computer-based treatment designed to help children control their attention, and (b) group-based CBT over 10 weeks. Parents completed the *Anxiety Disorders Interview Schedule: Child/Parent Versions* (ADIS-C-IV-C/P; Silverman & Albano, 1996) over the phone. The parent and child then attended an assessment session at the university clinic where children completed a visual-probe task and both parent and child completed questionnaires: the *Spence Children's Anxiety Scale* (SCAS-P, SCAS-C; Spence, 1998; Nauta et al., 2004) and the *Centre of Epidemiologic Studies Depression Scale for Children* (CES-DC; Weissman, Orvaschel, & Padian, 1980). After completing initial criteria, the children were randomly assigned to the ATP or ATC groups. Within 2 weeks of completing attention training, parents completed the ADIS-C-IV-C/P by telephone after families returned to the university to complete the post-attention training questionnaires and visual-probe task. All

children were offered group CBT following attention training to ensure all children received first-line treatment.

ANOVA results from bias scores revealed the ATP group showed a significantly greater attention bias toward happy faces after training and when compared to happy face biases of the ATC group. The completer analyses of ADIS-C-IV-C/P CSRs showed significant main effects of time ($F_{(1,22)} = 14.55, p < .001$) and group ($F_{(1,22)} = 4.98, p = .036$), which indicated significant reduction in clinical severity ratings (CSRs) from pre-to post-training in the ATP group. The ATP group had significant fewer diagnoses at post-training than the ATC group ($p = .042$).

The results established that this training induced an attention bias towards positive stimuli and also impacted clinical status. This study provided some evidence of therapeutic efficacy of ATP, but did not generate clear insights on the mechanism by which it changes clinical symptoms. The small sample size limits the ability to generalize findings.

Combined CBM-I and CBM-A Studies

In the following study, the researchers used a CBM approach that addressed both interpretive and attentional bias. Hirsh, Clark, and Mathews (2007) argued that these cognitive biases are likely to be mutually reinforcing.

Sportel et al. (2013) conducted a study in the Netherlands with 240 adolescents between the ages 13-15. The study investigated how Cognitive Behavior Therapy (CBT) and CBM affected adolescents' social and test anxiety. Participants were selected from 22 schools following a 2-year screening. Adolescents with DSM-IV diagnoses other than anxiety were not included. Participants in eight schools received CBT, seven schools received CBM, and seven

schools were assigned as control conditions; schools were randomly assigned to the three conditions.

The CBM intervention included twenty 40-min internet sessions that consisted of nine interpretation bias tasks and eight attention bias tasks. For the interpretative bias tasks, they were presented with open-ended social scenarios that were followed by word fragments that had to be solved. In the first session before each task they added imagination training where they were instructed to visualize the scenarios. For the attention bias tasks, visual probes and exogenous cueing task were used. The purpose was to guide participants to point their initial attention at positive stimuli versus the threatening faces or words. Participants were told to indicate as fast as possible whether the small arrow that appeared was directed upwards or downwards. Next, a short evaluative condition task of 240 trials was added to enhance self-esteem by associating self-relevant information with positive outcomes.

The CBT interventions consisted of 10 weekly sessions of 1.5 hours delivered in small groups by a licensed psychologist at school and after-school hours. Four components were included: (a) psychoeducation to recognize and understand anxiety symptoms, (b) task concentration training (TCT) to improve participants' awareness of their attentional focus and to improve attentional control, (c) cognitive restructuring to focus on the identification/modification of dysfunctional thoughts, and (d) anxiety exposure practice. Participants in the last session focused on how to avoid personal pitfalls and relapse. They also received homework assignments.

Pre- and posttests were administered, in addition to 6-month and 12-month follow-up assessments. Participants were assessed initially screened using two instruments to assess social

and test anxiety. If participants scored above cut-off for social and/or test anxiety the ADIS-C was administered. Based upon ADIS-C scores, participants with low-level social anxiety were selected as study participants.

Anxiety symptoms were assessed using three outcome measures: (a) the social phobia subscale of the *Revised Child and Anxiety Depression Scale* (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000), (b) the *Spielberger's Test Anxiety Inventory* (TAI; Van der Ploeg, 1988), and (c) the *Single Target Implicit Association Test* (stIAT; de Hullu, de Jong, Sportel, & Nauta, 2011). To examine changes in cognitive bias, the authors created two versions of visual probe tasks to examine attentional bias. They used two tasks to assess changes in interpretive bias: the *Recognition Task* (Salemink & van den Hout, 2010) and the *Adolescent Interpretation and Belief Questionnaire* (AIBQ; Miers, Blöte, Bögels, & Westenberg, 2008).

Differences across conditions for the various time segments showed an overall decrease in RCADS Social Phobia scores ($d = 0.42$). From posttest to 6-month follow-up test, the coefficients of the time x group interaction showed the reduction was stronger within the CBT condition than the control condition ($d = 0.41$). A significant overall decrease in test anxiety was found between pretest and posttest ($d = 0.42$). The CBT group showed a significantly stronger reduction of test anxiety scores compared to the control condition between pretest, posttest, and 6-month follow-up test ($d = 0.32$ and 0.58). For the stIAT, no overall time effects emerged.

Multilevel analyses revealed that interpretive bias, as measured by the *Recognition Task*, became less negative in the CBM condition compared to both the control group (coefficient = -0.48 , $p < .001$) and the CBT condition (coefficient = -0.46 , $p < .001$). Interpretations became more positive in the CBM condition compared to both the control group (coefficient = 0.43 ,

$p < .001$) and the CBT condition (coefficient = 0.43, $p < .001$). For social interpretive bias as measured by the AIBQ, interpretations became less negative in the CBM condition compared to the control group (coefficient = -0.33 , $p = .008$). Positive social interpretations generally increased (time effect coefficient = 0.33, $p = .001$), but no effect was reported for condition. For attentional bias to threatening faces, no significant effects were reported for either time or condition. Attentional bias to friendly faces increased in the CBM condition compared to the control group (coefficient = 20.12, $p = .017$).

This study was the first to test the efficacy of CBM using a multifaceted CBM approach. Over time, CBT resulted in a stronger decrease of test anxiety than CBM. In the CBM condition, scenario's focused on test anxiety, but participants did not receive direct intervention on how to cope. CBM showed a more favorable effect in reducing automatic social threat-related associations than CBT.

Due to rather low training attendance, results must be interpreted with caution. It should also be noted that they received informed consent from only one-third of the invited adolescents and their parents, so they cannot rule out the influence of the selection bias. Future research is required to test which element of the CBM was most effective in decreasing associations to threats and to test the various components of the early CBM intervention.

Summary

In this chapter, I reviewed nine studies that examined the effects of CBM treatments on the symptoms of adolescents with anxiety disorders. Table 2 presents a summary of these findings, which are discussed in Chapter 3.

Table 2**Summary of Chapter 2 Findings**

AUTHOR (DATE)	PARTICIPANTS	PROCEDURE	RESULTS
CBM-I Studies			
Vassilopoulos, Banerjee, & Prantzalou (2009)	43 children, ages 10-11 scoring high on the SASC-R	Ambiguous social situations task, three interpretation training sessions of 15 trials each, SASC- R and questionnaire, Children's Depression Inventory, Anticipated social interaction test	Positive CBM-I (vs No-training) reduced negative interpretations from pre- to post training. Positive CBM-I (vs No-training) also reduced social anxiety pre- to post training and on post-training challenge.
Lester, Field, & Muris (2010)	103 children split into a young (7-10 years) and old age group (11-15 years) from two primary schools and two secondary schools in the United Kingdom	Questionnaires: STAI-C & Fear Survey Schedule for Children- Revised (FSSC-R) CBM-I positive vs. negative, state anxiety: visual analogue mood scales, behavioral avoidance task (BAT), ambiguous vignettes task, debrief: Positive CBM-I	Positive animal CBM-I reduced negative interpretations pre-to post- training. Positive social CBM-I reduced negative interpretations pre- to post-training in older children.
Lau Molyneaux, Telman, & Belli (2011)	36 adolescents ages 13-18 years from schools in Oxfordshire and Buckinghamshire	Questionnaires, imagery training, Visual analogue scale, CBM-I training, Picture-rating filler task, Interpretation bias test	No significant differences found on task performance, Positively-trained individuals drew more positive interpretations of new information.
Lester, Field & Muris (2011)	76 children ages 6-11 years from a primary school in the United Kingdom	STAI-C trait anxiety scale, FSSC-R-SF, interpretation bias modification paradigm, ambiguous vignettes paradigm, visual analogue mood scales, bias modification, BAT, positive bias modification	Positive CBM-I reduced and Negative CBM-I increased negative interpretations pre- to post training. No effects of Positive CBM-I but negative CBM-I increased state anxiety pre-to post training. Training effects on post-training avoidance.
Salemink & Wiers (2011)	144 adolescents ages 14-16 years from a public secondary school in the Netherlands	STAI-C trait and state questionnaire using E-Prime pre and post, CBM-I training, and recognition task pre and post	Positive CBM-I (vs Neutral training) endorsed more positive and fewer negative interpretations at post- training (but not pre-training).
Vassilopoulos, Blackwell, Moberly, & Karahaliou (2011)	94 adolescents' ages 10-12 years recruited from primary schools in Greece.	Ambiguous social situations task, four sessions of 18 trials each positive training only, but presented verbally or imagined	Positive CBM-I decreased negative and increased benign interpretations pre-to post-training in both groups. Positive verbal CBM-I reduced social anxiety pre- to post-training.
Telman, Holmes, & Lau (2013)	49 adolescents aged 15-18 years from secondary schools around Oxfordshire	Imagination task, CBM-I training, Pre-and Post- Test, State Trait Anxiety Inventory, Visual Analogue Scale	No differences in reaction time during task performance were found. Negative and positive interpretation biases can be persuaded in adolescents.

Table 2 (continued)

AUTHOR (DATE)	PARTICIPANTS	PROCEDURE	RESULTS
CBM-A			
Krain Roy et al. (2008)	101 children and adolescents, ages 7-18 years with anxiety disorder diagnosis and 51 non-anxious youth, ages 9-18 years	Interviews using ADIS-IV-C, <i>Pediatric Anxiety Rating Scale for Children</i> , <i>Screen for Anxiety and Related Disorders</i> , <i>Multidimensional Anxiety Scale for Children</i> , <i>WISC-III- Vocabulary</i> and block design subtests, Visual probe task	Compared to adolescents without anxiety, children with anxiety demonstrated a greater attention bias towards threat faces. There was no difference towards happy faces.
Waters, Pittaway, Mogg, Bradley, & Pine (2012)	37 children randomly assigned to CBM- A conditions	<i>Diagnostic interview</i> , <i>Spence Children's Anxiety Scale</i> , visual probe tasks, Attention bias modification training, satisfaction and learning ratings	Children assigned to attention- towards-positive (ATP) condition showed greater post-training attention bias towards happy faces than attention-training-control group. Children also assigned to ATP showed reductions in clinician-rated diagnostic severity and number of diagnoses.
Combined CBM-I and CBM-A			
Sportel, de Hullu, de Jong, & Nauta (2013)	240 students from 24 schools between ages 12- 15	Interview, pre-and post CBM-I and CBM-A tasks and CBT interventions/ assessments	Interpretive bias became less negative in the CBM condition compared to the CBT and control group. Positive social interpretations also increased. For attentional bias to friendly faces increased in the CBM condition compared to the control group, but did not change to threatening faces.

Chapter 3: Conclusions and Recommendations

The purpose of this literature review was to investigate if Cognitive Bias Modification (CBM) approaches are effective in reducing anxiety symptoms in adolescents. Cognitive theorists propose that the tendency to interpret ambiguous information as threatening plays a causal role in the cause and maintenance of anxiety and that interpretive and attention biases are related to anxiety. CBM-Interpretive (CBM-I) and CBM-Attention (CBM-A) were developed to reduce anxiety symptoms and prevent the onset of anxiety disorders. In this Starred Paper, I reviewed nine studies that examined if CBM procedures were successful in decreasing adolescents' anxiety symptoms.

Conclusions

All seven CBM-I studies demonstrated that positive interpretation biases could be induced in adolescents (Lau et al., 2011; Lester et al., 2010; Lester et al., 2011; Salemink & Wiers, 2011; Telman et al., 2013; Vassilopoulos et al., 2009; Vassilopoulos et al., 2011). They also found that adolescents who receive interpretation training were significantly less anxious in upcoming social situations and had reduced social anxiety scores. These findings provide preliminary support for the use of interpretation bias training to positively modify children's anxiety.

Two studies reviewed CBM-A and found an association between pediatric anxiety and attention bias toward threat (Krain Roy et al., 2008; Waters et al. (2012). However, results were inconsistent. Krain Roy et al. found that anxious participants had a greater attention bias towards threat faces, but no differences toward happy faces. Waters et al. reported the positive condition showed a greater attention toward happy faces.

Sportel et al. (2013) evaluated the use of CBM-I and CBM-A as a combined approach. In this study, CBM had a more favorable effect on reducing automatic social threat-related associations. Sportel et al. also found that although attentional bias to friendly faces did change short term, the effects of CBM-I were more convincing.

In summary, CBM-I showed promising results in reducing and having a long-term effect on anxiety. Although the studies reviewed indicated CBM-I is effective in reducing adolescent anxiety, more research is needed in order to implement such an approach in an educational setting.

Recommendations for Future Research

CBM is a newly emerging and promising treatment for individuals with anxiety, and CBM-I results have shown promising results. However, several issues need to be addressed before the tools can be implemented in clinical settings.

First, research should be conducted to determine whether training effects on interpretational style emerge through demand effects. Adolescents in the studies may have learned the rule and answer the way that is considered the “correct” response. In order for this problem to be minimized, researchers could assess whether effects of training generalize to other measures of interpretation bias.

Researchers should also examine participants in more natural settings in order to determine reliability and validity of the studies. Related to this is the need to establish training characteristics that could enhance training effects. For example, in Vassilopoulos et al. (2012) study, the researchers began to identify moderators by including verbal versus imagery instructions.

With regard to CBM-A, further research is needed to evaluate the effect of emotional and environmental factors on attention biases. Due to the multi-site design used in the Krain Roy et al. (2008) study, it was difficult to control the environmental conditions along with the group variables. Creating an enjoyable more game-like design that is motivating for adolescents may influence the outcome and encourage participants to perform.

Implications for Practice

I wanted to research a treatment that could be implemented in a school setting with the students on my caseload who are diagnosed with or affected by anxiety symptoms throughout their day. Although the research had promising results, I am not convinced that CBM-I or CBM-A would be beneficial in a school environment. Although at first glance phone and computer applications appear to be a relatively “quick fix” to help decrease anxiety symptoms, I would not rely upon it as a means of preventing symptoms from reoccurring. I would certainly not recommend it as an only approach to use when feeling anxious. Although the research indicates promising results, I question how reasonable it is to think that only one approach is going to reduce an individual’s symptoms of anxiety without maintenance or follow up with a specialist.

I do not find the outcomes of these studies to be convincing. I am hesitant to use CBM as an intervention for students with high levels of anxiety in the classroom due to the results not being strong enough and having limitations in discussing maintenance and long-term effectiveness. If I had students use any CBM tools or programs, I would monitor and collect data frequently in order to empirically demonstrate whether a student’s anxiety is decreasing. Although these studies showed positive results, I would be more convinced with extended and more in-depth studies.

Summary

The increase of anxiety among adolescents has prompted researchers to investigate the use of interventions that can be delivered quickly and efficiently. Cognitive Bias Modification approaches are still too new to determine if it could be used as an intervention for adolescents with anxiety. There is evidence that supports effectiveness in CBM approaches, but is not consistent across both forms. Due to evidence being contradicted, more research is needed to investigate CBM approaches.

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