



Examining the effectiveness of cognitive bias modification for perfectionism in exploration of the mediating and moderating effects of body dissatisfaction and self-efficacy

Yun-Han Wang^{1,2} · Yun-Lin Wang^{1,2} · Kaylee Misener¹ · Maya Libben¹

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Abstract

The relationship between perfectionism, body dissatisfaction, and self-efficacy is unclear. This study attempted to distinguish the relationship between different dimensions of perfectionism and to examine how they relate to body dissatisfaction and self-efficacy. Experiment 1 examined the effectiveness of two types of Cognitive Bias Modification for Interpretation (CBM-I) techniques in the induction of perfectionism. Experiment 2 explored the mediation and moderation effects of perfectionism facets, body dissatisfaction, and self-efficacy in the induction of perfectionism. Participants were randomly assigned to one of the four CBM-I conditions and completed self-report measures of trait and state perfectionism, body dissatisfaction, self-efficacy, as well as a behavioural task that assessed perfectionistic behaviours before and after the CBM-I induction. The results indicated no significant differences in perfectionism between the experimental groups and the control groups following the perfectionism induction. Using baseline participant characteristics, body dissatisfaction was found to mediate socially-prescribed perfectionism and self-efficacy. Self-oriented perfectionism moderated the association between body dissatisfaction and self-efficacy. State perfectionism may not be influenced by a single session (30 trials) of CBM-I training. Treatment targeting body dissatisfaction may enhance self-efficacy in socially-prescribed perfectionists. Further, interventions that decrease self-oriented perfectionism may reduce body dissatisfaction while increasing self-efficacy.

Keywords Perfectionism · Cognitive bias modification · Interpretation bias · Body dissatisfaction · Self-efficacy

Cognitive Bias Modification (CBM) is a paradigm used to influence information processing by engaging in an attentional selectivity (CBM-A) or interpretive selectivity task (CBM-I; MacLeod & Mathews, 2012). For example, CBM-A has been used to reduce anxious affect by training attention *away* from anxiety inducing stimuli (e.g., an image of a knife) and *towards* neutral or positive stimuli (e.g., an image of a sunset) when both are presented (MacLeod & Mathews, 2012). Likewise, CBM-I has been used to modify interpretation bias by resolving a set of ambiguous scenarios in a positive or

negative way. Past research has found CBM-I to be effective in altering biases associated with mental health problems (e.g., depression and anxiety; Menne-Lothmann et al., 2014). CBM-I has also been used to induce cognitive biases in non-clinical participants which analogues to pathological biases in clinical samples (MacLeod & Mathews, 2012). For example, CBM-I can be used to induce transdiagnostic constructs (i.e., constructs that maintain or underlie psychopathology). In a university student sample, Yiend, Savulich, Coughtrey, and Shafran (2011) used CBM-I to induce perfectionism, which presents as a transdiagnostic personality variable across several eating disorder diagnoses (Fairburn, Cooper, Doll, & Welch, 1999).

Yun-Han Wang and Yun-Lin Wang contributed equally to this work.

✉ Yun-Han Wang
yun-han.wang@kcl.ac.uk

¹ Department of Psychology, University of British Columbia—Okanagan, Kelowna, British Columbia, Canada

² Institute of Psychiatry, Psychology & Neuroscience (IoPPN), King's College London, 4.07 Addiction Sciences Building (ASB), 4 Windsor Walk, London SE5 8BB, UK

Perfectionism and Eating Disorders

Perfectionism is characterized as having a need to perform tasks flawlessly and a tendency to set high standards for oneself (Hewitt & Flett, 1991b). Previous research has supported perfectionism as a risk factor low achievement (e.g.,

procrastination; Flett, Stainton, Hewitt, Sherry, & Lay, 2012) and mental health issues (e.g., eating disorders; Fairburn et al. 1999). Davis (1997) has examined how adaptive and maladaptive perfectionism relates to eating disorders. However, due to the multidimensional nature of perfectionism, the relationship between perfectionism and symptoms related to eating disorders remains inconsistent (Frost, Marten, Lahart, & Rosenblate, 1990; Hewitt & Flett, 1991a). Earlier research has attempted to examine how the distinct types of perfectionism relate to eating disorders. For instance, when categorising perfectionisms as adaptive and maladaptive, eating disorder patients have reported high levels of both kinds of perfectionism (Terry-Short, Owens, Slade, & Dewey, 1995). Additionally, when distinguishing the types of perfectionism further, self-oriented perfectionism (i.e., setting high standards for oneself; a form of personal standards perfectionism) and socially-prescribed perfectionism (i.e., the tendency to believe that others are setting unrealistic standards for oneself; a form of evaluative concerns perfectionism) has been found to differentially relate to anorexia nervosa and binge eating disorder, respectively (Hewitt & Flett, 1991b; Sherry & Hall, 2009). Yet, it is not yet clear how these facets may be differentially associated with body dissatisfaction.

Perfectionism and Body Dissatisfaction

Given the links between perfectionism and eating disorders (Garner, Olmstead, & Polivy, 1983), the present study focused on perfectionism's relationship to body dissatisfaction, a primary risk factor for eating disorders (Rosewall, Gleaves, & Latner, 2018). Body dissatisfaction refers to negative attitudes toward one's body (Stice & Shaw, 2002). A large body of literature supports that body dissatisfaction is associated with disordered eating attitudes and behaviours (Cooley & Toray, 2001; Stice, 2002; Stice, Ng, & Shaw, 2010). Most literature reports an association between perfectionism and body dissatisfaction. For example, Hewitt, Flett, and Ediger (1995) as well as Wade and Tiggemann (2013) found that individuals high in general perfectionism often set unrealistic expectations, which in turn may cause individuals to be overly critical in their appearance self-evaluations, resulting in increased body dissatisfaction. Yet, when distinguishing different types of perfectionism further, some facets of perfectionism are only associated with disordered eating but not body dissatisfaction. For example, results from Boone, Soenens, and Braet's (2011) as well as Boone, Soenens, Vansteenliste, and Braet's (2012) study suggest that, evaluative concerns perfectionism (i.e., concerns over mistakes; Frost, Heimberg, Holt, Mattia, & Neubauer, 1993) was associated with greater eating disorder symptoms (e.g., restraint and binge eating), but not with body

dissatisfaction. Conversely, Chang, Yu, Chang, and Jilani's (2016) was able to find an association between evaluative concerns perfectionism and body dissatisfaction. In regard to personal standards perfectionism (i.e., high goal orientation; Frost et al., 1993), some studies did not find associations with bulimic symptoms or body dissatisfaction (Boone, Soenens, & Braet, 2011; Boone, Soenens, Vansteenliste, & Braet, 2012). Previous research suggests a strong relationship between general perfectionism and body dissatisfaction (Hewitt, Flett, & Ediger, 1995; Wade & Tiggemann, 2013). However, the relationship between different facets of perfectionism and body dissatisfaction is inconsistent, where some researchers are able to find significant associations of both evaluative concerns and personal standards perfectionism with body dissatisfaction (Wade & Tiggemann, 2013), while others are not able to replicate this relationship (Bardone-Cone et al., 2007). Similarly, research investigating the relationship between symptoms of bulimia and perfectionism also demonstrated inconsistent relationships, where some studies have demonstrated positive correlations (Joiner Jr., Heatherton, & Keel, 1997) while others report a lack of relationship (Fryer, Waller, & Kroese, 1997). Boone, Soenens, and Luyten (2014) suggested that perfectionism results in body dissatisfaction because it increases one's desire to obtain a perfect body, but when body perfection is unattainable it causes dissatisfaction. The current study focused on using CBM-I to further examine the relationship between different types of perfectionism, body dissatisfaction, as well as how they both relate to self-efficacy, an important construct that may influence the relationship between perfectionism and body dissatisfaction.

Self-Efficacy

Self-efficacy refers to the belief in one's ability to succeed or yield expected outcomes (Bandura, 1977). Past research has found that low self-efficacy is related to depression, anxiety, feelings of helplessness (Tahmassian & Jalali Moghadam, 2011), and specific types of perfectionism. Specifically, low self-efficacy has been correlated with self-oriented perfectionism (Hart, Gilner, Handal, & Gfeller, 1998), while high self-efficacy has been associated with socially-prescribed perfectionism (Hart, Gilner, Handal, & Gfeller, 1998). Additionally, Bardone-Cone, Abramson, Vohs, Heatherton, and Joiner (2006) proposed that individuals high in both perfectionism and self-efficacy tend to work diligently at maintaining healthy diet and exercise behaviours, which may influence one's body image. However, precisely how specific types of perfectionisms (e.g., self-oriented or socially-prescribed) relate to body dissatisfaction while considering self-efficacy remains unclear.

Three-Factor Interactive Model of Bulimic Symptom Development

Joiner Jr., Heatherton, and Keel (1997) found that perfectionistic individuals are at higher risk for experiencing bulimic symptoms when they have body dissatisfaction. Later investigations have reported significant interactions between perfectionism, body dissatisfaction, and self-esteem in predicting bulimic symptoms, known as the three-factor interactive model of bulimic symptom development (Vohs, Bardone, Joiner, Abramson, & Heatherton, 1999; Vohs et al., 2001). Given that self-esteem requires a positive regard towards oneself and general cognitive expectations of success (Heatherton & Vohs, 2001), and that self-efficacy is predictive of, and related to, self-esteem (Maggiore, Johnston, & Rossier, 2016), this model offered direction for the present study. Specifically, bulimic symptoms were found to be greater in individuals with high perfectionism, perceptions of being overweight, and a low self-esteem. However, further research failed to replicate this model (Shaw, Stice, & Springer, 2004; Steele, Corsini, & Wade, 2007; Watson, Steele, Bergin, Fursland, & Wade, 2011), highlighting the complexity of this interaction and the possibility of alternative models. In examination of previous studies' methodology, the influence of perfectionism's facets on the interaction of the model has not been elucidated. Thus, this study utilized CBM-I methodology to induce perfectionism in a university sample, which was used to distinguish the relationship between different dimensions of perfectionism and to examine how they relate to body dissatisfaction and self-efficacy.

Cognitive Bias Modification for Interpretation

Perfectionism-related interpretation biases have been associated with increased perfectionistic behaviour (Yiend, Savulich, Coughtrey, & Shafran, 2011). In a typical Cognitive Bias Modification for Interpretation (CBM-I) task, participants are asked to complete a word fragment with missing letters from a statement describing an ambiguous scenario (MacLeod & Mathews, 2012). The missing letters in the sentence are cues designed to facilitate disambiguation of the scenario. There are mixed findings about the efficacy of CBM in general (Hallion & Ruscio, 2011; Menne-Lothmann et al., 2014). Some studies suggest that the cues in the missing letters decrease the attention towards the information presented in the scenario, which reduces the effectiveness of the modification (Beard, 2011; Hoppitt, Mathews, Yiend, & Mackintosh, 2010). Specifically, Beard (2011) proposed that participants' focus on the incomplete word prevents their processing of the scenario's content, thus resulting in a weaker bias induction. Some researches have incorporated comprehension and recognition tests after the CBM-I manipulation

to ensure participants have processed and attended to the information (Hoppitt, Mathews, Yiend, & Mackintosh, 2010; Yiend, Savulich, Coughtrey, & Shafran, 2011). However, no research has closely examined the results of these manipulation checks, and thus the effectiveness of the missing letter cognitive bias modification remains unclear. As such, Experiment 1 employed two separate CBM-I techniques for the purpose of comparing the effectiveness of the modifications, which allows for the assessment of mediating and moderating effects of body dissatisfaction and self-efficacy after inducing state perfectionism (Experiment 2).

Experiment 1

The aim of Experiment 1 was to examine the methodology and evaluate the effectiveness of the CBM-I paradigm in the induction of perfectionism. Two separate CBM-I techniques were employed to compare the effectiveness of the modifications. In addition, participants completed a memory test (i.e., six *yes/no* questions regarding whether the scenario was presented in the paradigm) at the end of the CBM-I task, as a manipulation check. Each CBM-I technique was paired with a control version, resulting in four conditions. For the traditional CBM-I technique, perfectionism was induced by asking participants to fill in the missing letters in a sentence with a perfectionistic connotation (condition 1). In the control group for this CBM-I technique, participants were asked to fill in the missing letters of a sentence without a perfectionistic context (condition 2). In addition, we employed a novel CBM-I technique that required participants to provide a word that fits the perfectionism valence presented (condition 3). In the control group for this CBM-I technique, participants were asked to come up with a word that fits the neutral context (condition 4). We compared the novel CBM-I technique (i.e., missing word technique) with the missing letter technique, in order to examine whether the new CBM-I paradigm was more successful than the traditional CBM-I in inducing perfectionistic biases. The dependent variables were self-reported and behavioural state perfectionism, as assessed by a self-report measure and a behavioural bead-sorting task (see Measures section for details). The induction was deemed successful if participants demonstrated significantly higher behavioural state perfectionism (i.e., chose to check their bead sorting and spent a longer time checking), or higher self-reported state perfectionism. It was hypothesized that:

- H1: Participants in the experimental groups (conditions 1 and 3) would report higher state perfectionism, as measured by the Perfectionism Cognitions Inventory, in the posttest than the participants in the control groups (conditions 2 and 4) and would display more perfectionistic

behaviours by checking and spending more time on the bead-sorting task.

- H2: Participants in condition 3 would report higher state perfectionism, as measured by the Perfectionism Cognitions Inventory, in the posttest than the participants in condition 1 and would display more perfectionistic behaviours by checking and spending more time on the bead-sorting task; thus, indicating that the word-based perfectionism CBM-I is more effective in inducing perfectionism than the letter-based perfectionism CBM-I.

Method

Participants

A total of 243 undergraduate students were recruited via the university's recruitment platform. Students were eligible to participate if they were at least 18-years-old and had a working knowledge of English (e.g., able to read and write at a Grade 10 level). Students with colour blindness were excluded from the study as discernment of coloured beads was necessary for the bead-sorting task. Missing data and outliers were excluded from analyses. Specifically, data from participants who scored less than 66% on the memory test were excluded from analysis ($n = 21$; i.e., participants needed to perform better than chance; Kantner & Lindsay, 2012). Data from participants who failed attention check questions ($n = 4$; i.e., questions that explicitly asked participants to choose a response such as "always") or did not complete the surveys ($n = 1$) were also excluded from analysis. The resulting sample consisted of 217 participants (44 men and 173 women; 95.9% aged between 18 and 25; condition 1 $n = 52$; condition 2 $n = 54$; condition 3 $n = 45$; condition 4 $n = 66$). Participants were primarily Caucasian (67.3%; 18% Asian, 1.8% Black, 1.8% Latin American, 1.4% Aboriginal, 8.8% other, and 0.9% preferred not to indicate) and varied by current year in their program (22.6% first year, 28.1% second year, 28.6% third year, 16.1 fourth year, 0.9% fifth year, and 2.7% unclassified).

Measures

Bead Sorting Task

Following the protocol from Yiend, Savulich, Coughtrey, and Shafran (2011), perfectionistic behaviour was assessed through a bead-sorting task (Bouchard, Rhéaume, & Ladouceur, 1999). The bead-sorting task involved 12 empty narrow-necked and semi-transparent bottles (set up in a horizontal line formation in front of the participant), and 40 coloured beads (five beads in each of eight colours). Participants were asked to pick up one bead at a time and sort

the beads according to colour into each bottle as quickly and as accurately as possible for 1 min. After 1 min, participants were given the option to check the accuracy of their sorting or to finish sorting the beads if they had not completed the task in the allotted time. If participants chose to check or finish their sorting, they were permitted to use as much time as they required. The number of seconds that the participants chose to spend checking or finishing their sorting was recorded by the research assistant. More time spent on checking and finishing bead sorting indicates more perfectionistic behaviour.

Perfectionism Cognitions Inventory

State perfectionism was measured using the Perfectionism Cognitions Inventory (PCI; Flett, Hewitt, Blankstein, & Gray, 1998). Modifications were made in the instructions of the measure so that it assessed the frequency of perfectionism thoughts over the past hour, instead of over the last week. The PCI is a 25-item self-report measure designed to assess state perfectionism (e.g., "Why can't I be perfect") on a scale ranging from 0 (*not at all*) to 4 (*all the time*). Higher scores on the PCI indicate higher levels of state perfectionism. Past research suggests that the PCI has good concurrent validity with the MPS, with correlation coefficient ranging from .37 to .63 (Flett, Hewitt, Whelan, & Martin, 2007). In the present study, the internal consistency of the PCI ranged from $\alpha = .86$ to .89.

Multidimensional Perfectionism Scale

Trait perfectionism was assessed using the Multidimensional Perfectionism Scale (MPS; Hewitt & Flett, 1991b). The MPS is a 45-item self-report measure designed to assess perfectionism. Its three subscales measure self-oriented perfectionism (MPS-self; e.g., "When I am working on something, I cannot relax until it is perfect"; the internal consistency of this subscale was $\alpha = .60$), other-oriented perfectionism (MPS-other; e.g., "Everything that others do must be of top-notch quality"; the internal consistency of this subscale was $\alpha = .41$), and socially prescribed perfectionism (MPS-social; e.g., "I find it difficult to meet others' expectations of me"; the internal consistency of this subscale was $\alpha = .61$). Participants rated their responses on a 7-point Likert scale ranging from 1 (*disagree*) to 4 (*agree*). Higher scores on the MPS indicate greater perfectionism. The MPS has a test-retest correlation coefficient ranging from .75 to .85, with adequate levels of concurrent validity (Hewitt & Flett, 1991b). The internal consistency of the overall scale was $\alpha = .52$.

Cognitive Bias Modification for Interpretation Task

Perfectionism was manipulated through a Cognitive Bias Modification for Interpretation (CBM-I) task. Participants

were informed that they would work through an interpretation task consisting of 30 trials. In each trial, participants were presented with a short scenario (adapted from Yiend, Savulich, Coughtrey, & Shafran, 2011). Participants in the traditional CBM-I group were asked to fill in the missing letter in a series of statements, whereas participants in the word-generation group were asked to produce a word that fits the valence of the statements. Participants were randomly assigned into one of the four conditions of the computer-based cognitive bias task. In condition 1, participants were asked to fill in the missing letters in a sentence with a perfectionistic connotation (e.g., “You have spent all your time reviewing for an important exam. You feel you must do well otherwise you will let everyone d_wn”). In condition 2, participants were asked to fill in the missing letters of a sentence without a perfectionistic connotation (e.g., “You will need to wait for thirty minutes until class starts. You go to the library. You find a seat and sit down. You get out your book and start re_ding”). In condition 3, participants were asked to provide a *word* that fits the perfectionism valence presented (e.g., “You have spent all your time reviewing for an important exam. You feel you must do well otherwise you will let everyone _____ [-]”). In condition 4, participants were asked to provide a *word* that fits the non-perfectionism valence presented (e.g., “You will need to wait for thirty minutes until class starts. You go to the library. You find a seat and sit down. You get out your book and start _____”).

Procedure

The study was approved by the behavioural research ethics board of the University of British Columbia Okanagan. Participants completed the bead-sorting task after providing informed consent. Next, participants completed a battery of questionnaires including demographics (e.g., gender, age, race, year in program), the MPS, the PCI, and the CBM-I task. Following the CBM-I task, participants completed a distraction task online (adapted from Black & Grisham, 2018), in which they were asked to rate the pleasantness and vividness of 20 neutral images for 10 min. The set of neural images did not contain food/body-related images and were sourced from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005). The purpose of the distraction task was to provide a delay between the manipulation and the assessment of its effect to allow time for any potential shifts in mood (e.g., anxiety or worry) resulting from the CBM-I task to neutralize (Black & Grisham, 2018). Following the distraction task, participants completed the memory test to assess whether appropriate attention was allocated to the CBM-I task. Next, they completed both the bead-sorting task and the PCI again.

Data Analysis

All data analyses were performed using R version 3.4.1. To examine the effectiveness of the experimental CBM-I conditions (i.e., conditions 1 and 3) and CBM-I groups (i.e., experimental and control) in inducing perfectionism, two separate two-way mixed design factorial Multivariate Analysis of Variances (MANOVAs) were performed. Trait perfectionism was controlled as a covariate to examine the effects of CBM induction on state perfectionism using an Analysis of Covariance (ANCOVA). Lastly, independent *t* tests were conducted to examine whether memory test performance differed across conditions.

Results

CBM-I Efficacy

Descriptive Statistics

Means and standard deviations are provided in Table 1.

Assumptions

Homogeneity of Covariance Homogeneity of covariance was examined by comparing the variances (see Table 1) and covariances (for PCI scores, checking time, and checking choice) in the variance-covariance matrices (see Tables S1 & S2 in electronic supplementary material). While variance existed, larger samples produce greater variances and covariances, the analysis may proceed despite matrices differing across groups (Field, Miles, & Field, 2012).

Multivariate Analysis of Variance (MANOVA)

A two-way mixed design factorial MANOVA was conducted to compare the effects of each experimental CBM-I group (i.e., conditions 1 and 3) and testing time (i.e., pre and post) on PCI, bead-checking time, and checking choice. Using Roy’s largest root (i.e., the eigenvalue for the first discriminant function, which also represents the proportion of explained variance to unexplained variance; Field, Miles, & Field, 2012), the effect of CBM-I group was not significant, $\Theta = .01$, $F(3, 188) = 0.73$, $p = .54$, $\eta^2 = .01$. In addition, the effect of testing time was not significant, $\Theta = .04$, $F(3, 188) = 2.32$, $p = .08$, $\eta^2 = .04$. Further, the interaction effect between CBM-I group and testing time was not significant, $\Theta = .00$, $F(3, 188) = 0.15$, $p = .93$, $\eta^2 = .00$. Since there were no significant effects, no follow-up analysis was conducted.

Another two-way mixed design factorial MANOVA was conducted to compare the effects of CBM-I group overall (i.e., combined experimental and control groups)

Table 1 Mean (M), Standard Deviation (SD), Shapiro-Wilks (W), and Variance

CBM	<i>M</i>		<i>SD</i>		<i>W</i>		Variance	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Condition 1					.74***	.58***		
PCI	49.46	49.25	18.74	20.83			351.19	433.21
Time	13.17	8.90	19.22	19.77			369.44	390.95
Choice	0.48	0.33	0.50	0.47			0.25	0.22
Condition 3					.93*	.80***		
PCI	48.69	48.69	21.09	21.85			444.86	477.45
Time	13.98	9.58	16.01	14.92			256.47	222.70
Choice	0.60	0.38	0.50	0.49			0.25	0.24
Experimental					.74***	.59***		
PCI	49.10	48.99	19.76	21.19			390.61	449.05
Time	13.55	9.22	17.72	17.60			313.98	309.88
Choice	0.54	0.35	0.50	0.48			0.25	0.23
Control					.94*	.80***		
PCI	50.63	48.95	18.69	21.52			349.33	463.01
Time	13.53	11.14	18.86	21.89			355.65	479.00
Choice	0.47	0.35	0.50	0.47			0.25	0.23

Note. * $p < .05$. ** $p < .01$. *** $p < .001$

and testing time (i.e., pre and post) on PCI, bead-checking time, and checking choice. Using Roy's largest root, the effect of CBM-I group was not significant, $\Theta = .01$, $F(3, 428) = 0.96$, $p = .41$, $\eta^2 = .01$. However, the effect of testing time was significant, $\Theta = .02$, $F(3, 428) = 3.45$, $p = .02$, $\eta^2 = .02$. The interaction effect between CBM-I group and testing time was not significant, $\Theta = .00$, $F(3, 428) = 0.25$, $p = .86$, $\eta^2 = .00$. Since there was a significant effect for time, follow-up analysis was conducted. A follow-up ANOVA indicated that testing time had a significant effect on checking choice, $F(1, 430) = 9.81$, $p = .002$, $\eta^2 = .63$, indicating that checking choice was significantly lower in the posttest bead sorting task.

CBM-I Efficacy after Controlling for Trait Perfectionism

Descriptive Statistics

Means, standard deviations, and adjusted means for conditions 1 and 3, as well as the experimental (i.e., conditions 1 and 3 combined) and control (i.e., conditions 2 and 4 combined) groups are provided in Table 2.

Assumptions

Homogeneity of Variance A Levene's test was conducted to assess homogeneity of variance. The variance in PCI did not significantly vary across participants in conditions 1 and 3,

$F(1, 95) = 0.00$, $p = .96$. Further, the variance in PCI did not significantly vary across participants in the experimental and control groups, $F(1, 215) = 0.00$, $p = .97$.

Independence of the Covariate and Treatment Effect The main effect of CBM-I group (i.e., conditions 1 and 3) was not significant, $F(1, 95) = 0.04$, $p = .84$. Similarly, the main effect of CBM-I (i.e., experimental and control) was also not significant, $F(1, 215) = 0.39$, $p = .53$. These results indicate

Table 2 Mean (M), Standard Deviation (SD), Adjusted Mean, and Standard Error (SE)

CBM	<i>M</i>		<i>SD</i>		<i>Adjusted M</i>	<i>SE</i>
	Pre	Post	Pre	Post	Post	Post
Condition 1						
MPS	184.83		28.23			
PCI		49.25		20.81	49.00	2.34
Condition 3						
MPS	183.64		30.49			
PCI		48.69		21.85	48.97	2.51
Experimental						
MPS	181.79		29.51			
PCI		48.99		21.19	48.35	1.51
Control						
MPS	184.28		29.15			
PCI		48.95		21.52	49.47	1.68

that MPS was an appropriate covariate to be used in the analysis.

Homogeneity of Regression Slopes The interaction between MPS and PCI in conditions 1 and 3 was not significant, $F(1, 93) = 2.06$, $p = .15$, meaning the assumption of homogeneity of regression slopes was not violated. Similarly, this was also seen in the interaction between MPS and PCI in the experimental and control groups, $F(1, 213) = 0.15$, $p = .70$.

Analysis of Covariance (ANCOVA)

The covariate, trait perfectionism, was significantly related to the posttest state perfectionism score in conditions 1 and 3, $F(1, 94) = 57.57$, $p < .001$, $r = .61$. However, the effect of the CBM-I group after controlling for the effect of trait perfectionism was not significant, $F(1, 94) = 0.00$, $p = .99$, $\eta_p^2 = .0003$. Similarly, the results suggest that trait perfectionism was significantly related to the posttest state perfectionism score in the experimental and control groups, $F(1, 214) = 146.8$, $p < .001$, $r = .64$. However, the effect of the CBM-I group after controlling for the effect of trait perfectionism was also not significant, $F(1, 214) = 0.24$, $p = .62$, $\eta_p^2 = .00$.

Memory Tests

Independent T Tests

In further examination of the two different CBM-I techniques, scores on the memory tests were compared. Participants in condition 3 ($M = 91.67\%$, $SD = 12.04$) had higher but not significant memory test scores than participants in condition 1 ($M = 90.71\%$, $SD = 11.15$), $t(1, 96) = 0.41$, $p = .34$, $r = .04$. Similarly, participants in condition 4 ($M = 98.23$, $SD = 6.62$) had higher but not significant memory test scores than participants in condition 2 ($M = 96.60$, $SD = 8.18$), $t(1, 118) = 1.20$, $p = .12$, $r = .11$. Interestingly, memory test scores for the control groups (i.e., conditions 2 and 4 combined; $M = 97.50$, $SD = 7.37$) were significantly higher than the experimental groups (i.e., conditions 1 and 3 combined; $M = 91.16$, $SD = 11.47$), $t(1, 218) = 4.86$, $p < .001$, $r = .31$.

Experiment 2

The original aim of experiment 2 was to explore the mediating and moderating effects of perfectionism, body dissatisfaction, and self-efficacy on the success of inducing perfectionism through the CBM-I. However, as the CBM-I paradigms in experiment 1 were not successful in influencing state perfectionism, it was not possible to examine mediation and moderation effects based on the original experimental design. The hypotheses were adjusted to examine the underlying

mediation and moderation effects based on participant characteristics at baseline:

- H1: Previous research suggests that perfectionism is strongly associated with self-efficacy, and that both perfectionism and self-efficacy relate to disordered eating. However, how different types of perfectionism relate to different levels of self-efficacy remain unexplored. Since the majority of research suggest that body dissatisfaction is linked to general perfectionism as well as self-efficacy, we would like to explore whether body dissatisfaction explains the relationship between different types of perfectionism and self-efficacy. It was hypothesized that body dissatisfaction would serve as a mediator between self-oriented perfectionism and self-efficacy.
- H2: Since both self-oriented and socially-prescribed perfectionism have been found to associate with body dissatisfaction (e.g., Wade & Tiggeman, 2013) and self-efficacy, body dissatisfaction was also hypothesized to mediate the relationship between socially-prescribed perfectionism and self-efficacy.
- H3 & H4: Previous research demonstrates that self-efficacy is differentially related to specific facets of perfectionism. However, the impact of these facets on the relationship between body dissatisfaction and self-efficacy remains unclear. Since perfectionism qualifies as a moderator between body dissatisfaction and disordered eating (Welch, Miller, Ghaderi, and Vaillancourt (2009), we hypothesized that self-oriented perfectionism (H3) and socially-prescribed perfectionism (H4) would serve as moderators between body dissatisfaction and self-efficacy.

Method

Participants

Participants included in this experiment were the same as Experiment 1, with the removal of missing data and outliers as described above. However, the inclusion criteria were adjusted to fit the research questions. The current study examined only the data from female students. Despite evidence suggesting that genders are largely equivalent on measures of self-efficacy (Huang, 2013), body dissatisfaction has been demonstrated to differ across males and females (Furnham, Badmin, & Sneade, 2018). As such, male participants ($n = 45$) were excluded resulting in a sample size of 173. In order to include a full range of eating behaviours, no screening was performed to exclude participants based on the presence or history of eating disorders.

Measures

The measures and task included in the analyses for Experiment 2 include: the MPS (Hewitt & Flett, 1991b), the PCI (Flett, Hewitt, Blankstein, & Gray, 1998), the bead-sorting task (Bouchard, Rhéaume, & Ladouceur, 1999; Yiend, Savulich, Coughtrey, & Shafran, 2011), as described above in Experiment 1, as well as the General Self-Efficacy Subscale (GSES; Sherer et al., 1982), and the Body Shape Questionnaire (BSQ; Cooper, Taylor, Cooper, & Fairburn, 1987).

General Self-Efficacy Subscale

Self-efficacy was measured using the General Self-Efficacy subscale (GSES; Sherer et al., 1982) of the Self-Efficacy Scale. The GSES is a 17-item self-report measure in which participants respond to questions (e.g., “When I make plans, I am certain that I can make them work”) on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores on the GSES indicate higher self-efficacy. The GSES has adequate reliability ($\alpha = .86$) and validity ($\alpha = .87$; Bardone-Cone, Abramson, Vohs, Heatherton, & Joiner, 2006). The internal consistency of this subscale was $\alpha = .58$.

Body Shape Questionnaire

The Body Shape Questionnaire (BSQ-34; Cooper, Taylor, Cooper, & Fairburn, 1987) was used to assess concerns related to body image. The BSQ is a 34-item self-report measure that requires the participant to rate how often they experience concerns about body shape (e.g., “Has worry about your shape made you diet?”) on a 6-point scale ranging from 1 (*never*) to 6 (*always*). High scores on the BSQ indicate high body dissatisfaction and concerns about body shape and weight. The BSQ has good test-retest reliability ($\alpha = .88$) and concurrent validity (Rosen, Jones, Ramirez, & Waxman, 1996). The internal consistency of the BSQ was $\alpha = .97$.

Data Analysis

All data analyses were performed using R version 3.4.1. Mediation effects were explored using multiple regression and bootstrapping. Moderation effects were examined using hierarchical multiple regression and simple slope analyses.

Results

Body Dissatisfaction as a Mediator for Self-Oriented Perfectionism and Self-Efficacy

Means and standard deviations were computed for all dependent variables (see Table S3 in electronic supplementary

material). To establish a mediation effect, three steps need to be completed (Baron & Kenny, 1986). First, a significant relationship between the predictor and outcome variable is required (step 1). Second, a significant relationship between the predictor and mediator must be present (step 2). Third, the mediator and outcome variable must also demonstrate a significant relationship (step 3). A bivariate correlation of baseline data on all dependent variables was conducted to examine the relationship between variables (see Table S4 in electronic supplementary material). In step 1, scores on the MPS-Self was positively and significantly correlated with GSES, $r(171) = .24, p = .002$. Applying Kenny, Kashy, and Bolger’s (1998) formula ($N[1-r_{xm}^2]$) to determine the sample size needed to have sufficient power in mediation analysis, our sample size of 173 is considered to be in the effective range ($n > 168$). For step 2, MPS-Self was positively and significantly correlated with scores on the BSQ, $r(171) = .16, p = .04$. Finally, in step 3, BSQ scores were negatively and significantly correlated with GSES scores, $r(171) = -.32, p < .001$. The three mediation steps were met for this hypothesized mediation model. Thus, multiple regression analysis was conducted to examine the mediation effect.

The data met the assumptions of collinearity (MPS-Self tolerance = .97, $VIF = 1.03$; BSQ tolerance = .97, $VIF = 1.03$) and independent errors (Durbin-Watson value = 2.13). For the multiple regression, self-oriented perfectionism (predictor) was significantly related to self-efficacy (outcome) by regressing GSES on MPS-Self, $B = 0.19, t(171) = 3.22, p < .001$. Next, body dissatisfaction was regressed on self-oriented perfectionism, $B = 0.40, t(171) = 2.11, p = .04$, establishing that self-oriented perfectionism was significantly related to body dissatisfaction. Next, self-efficacy was regressed on body dissatisfaction, which was also statistically significant, $B = -0.10, t(171) = -4.36, p < .001$. Finally, we examined whether the relationship between self-oriented perfectionism and self-efficacy was significantly reduced (suggesting partial mediation) or absent (complete mediation) when body dissatisfaction was added to the model (see Table S5 in electronic supplementary material for a summary). Regression analysis indicated that when body dissatisfaction was added to the model, the strength of the relationship between self-oriented perfectionism and self-efficacy increased, $B = 0.23, t(171) = 4.24, p < .001$, suggesting that there were no mediation effects (see Fig. 1). Previous researchers have discontinued examining the significance of mediation effects with similar results. However, Zhao, Lynch, and Chen (2010) recommend further categorizing nonmediation through examining direct and indirect effects. Follow-up bootstrapping tests were conducted to test the significance of indirect and direct effects (Preacher & Hayes, 2004). With bootstrap samples set to 5000, the total effect was statistically significant, $-.18, p = .003, 95\% CI [.06, .31]$. The direct effect was also statistically significant, $.22, p < .001, 95\% CI [.22, .11]$, however, the indirect effect was

not statistically significant, $-.04, p = .06, 95\% \text{ CI } [-.10, .00]$, suggesting that this is a direct-only nonmediation. As proposed by Zhao, Lynch, and Chen (2010), direct-only nonmediation suggests that the theoretical framework of this mediation model is not incorrect, but that there is a likelihood of undiscovered mediators present, which present problems for the model.

Body Dissatisfaction as a Moderator for Self-Oriented Perfectionism and Self-Efficacy

Despite the BSQ yielding a direct-only nonmediation, the relationship between MPS-Self, BSQ, and GSES was strong. Thus, BSQ scores were further examined as a moderator between self-oriented perfectionism and self-efficacy. Hierarchical multiple regression analysis was conducted to predict the overall self-efficacy index from self-oriented perfectionism. The results indicated that self-oriented perfectionism was a significant predictor of self efficacy, $B = 0.18, t = 4.24, p < .001$, and that it accounted for a significant amount of the variability in self-efficacy, $R^2 = .06$, adjusted $R^2 = .05, F(1, 171) = 10.38, p = .002$ (see Table S6 in the electronic supplementary material for a summary). Next, the results indicated that the linear combination of self-oriented perfectionism ($B = 0.23, t = 4.24, p < .001$) and body dissatisfaction ($B = -0.11, t = -5.19, p < .001$) accounted for a significant amount of the variability in self-efficacy, $R^2 = .19$, adjusted $R^2 = .18, F(2, 170) = 10.38, p < .001$. A third analysis was conducted to evaluate the interaction between self-oriented perfectionism and body dissatisfaction. The results showed that the interaction between MPS-Self and BSQ ($B = 0.00, t = 2.08, p = .04$) explained a significant amount of variance in self-efficacy, $R^2 = .21$, adjusted $R^2 = .19, F(3, 169) = 14.67, p < .001$. Thus, BSQ was a significant moderator of the relationship between MPS-Self and GSES. Follow-up simple slope analysis was conducted. The unstandardized simple slope for participants with 1 SD below the mean of BSQ, at the mean, and 1 SD above the mean were $.11, p = .14, .21, p = .001, .31, p < .001$, respectively. Simple slope analysis

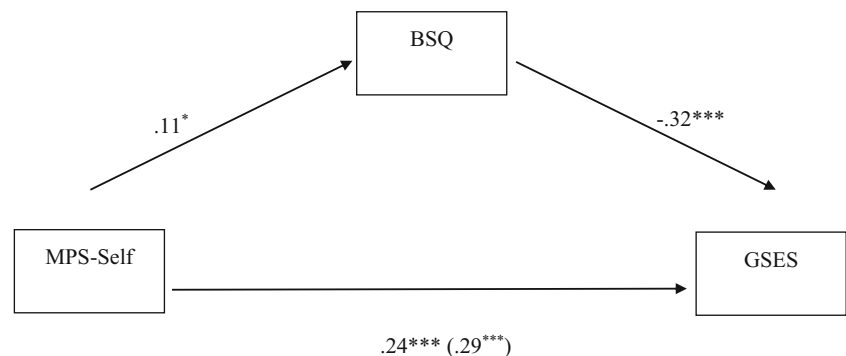
revealed that when BSQ was higher, the association between self-oriented perfectionism and self-efficacy was strengthened. The associations between self-oriented perfectionism and self-efficacy were gradually increased in the $M - SD, M$, and $M + SD$ BSQ groups (see Fig. S1 in the electronic supplementary material). In other words, high body dissatisfaction was a factor that strengthened the association between self-oriented perfectionism and self-efficacy.

Body Dissatisfaction as a Mediator between Socially-Prescribed Perfectionism and Self-Efficacy

Bivariate correlations were conducted to examine the relationship between socially-prescribed perfectionism, body dissatisfaction, and self-efficacy. MPS-Social was negatively correlated with GSES, $r(171) = -.17, p = .02$. In application of Kenny, Kashy, and Bolger’s (1998) formula ($N[1 - r_{xm}^2]$), the present sample size of 173 is considered sufficient for great power in mediation analysis ($n > 146$). Next, MPS-Social was positively correlated with BSQ, $r(171) = .39, p < .001$. Further, BSQ was negatively correlated with GSES, $r(171) = -.32, p < .001$. According to the standards put forth by Kenny, Kashy, and Bolger (1998), these findings suggest a strong mediation, given the similarity in the strength of the relationships between the mediator and outcome variables, and the mediator and predictor variables. Multiple regression analyses were conducted to examine the mediation effect.

The data did not violate assumptions of collinearity (MPS-Social tolerance = .84, $VIF = 1.18$; BSQ tolerance = .84, $VIF = 1.18$) or independent errors (Durbin-Watson value = 2.06). Socially-prescribed perfectionism (predictor) was significantly related to self-efficacy (outcome) by regressing GSES on MPS-Social, $B = -0.14, t(171) = -2.32, p = .02$. Further, socially-prescribed perfectionism was significantly related to body dissatisfaction, when body dissatisfaction was regressed on socially-prescribed perfectionism, $B = 1.06, t(171) = 5.61, p < .001$. Furthermore, significant results were found when self-efficacy was regressed on body dissatisfaction, $B = -0.10,$

Fig. 1 Standardized regression coefficients for the relationship between MPS-Self and GSES as mediated by BSQ. The standardized regression coefficient between MPS-Self and GSES, controlling for BSQ is in parentheses. Note. * $p < .05$, ** $p < .01$, *** $p < .001$



$t(171) = -4.36, p < .001$. Finally, body dissatisfaction was added to the model (see Table 3) to examine whether the relationship between socially-prescribed perfectionism and self-efficacy was reduced (i.e., partial mediation) or lost (i.e., complete mediation). When body dissatisfaction was added to the model, regression analysis revealed that the relationship between socially-prescribed perfectionism and self-efficacy was not significant, $B = -0.05, t(171) = -0.75, p = .45$, indicating a complete mediation effect (see Fig. 2). Bootstrapping was used to test the significance of indirect and direct effects (Preacher & Hayes, 2004). The bootstrap samples were set to 5000. The results showed that the total effect ($-0.14, p = .04, 95\% \text{ CI} [-0.27, -0.01]$) and the indirect effect ($-0.10, p < .001, 95\% \text{ CI} [-0.16, -0.04]$) were both significant. Since the direct effect was not significant, $-0.05, p = .50, 95\% \text{ CI} [-0.19, .10]$, the mediation effect demonstrated significance.

Self-Oriented Perfectionism Moderates Body Dissatisfaction and Self-Efficacy

As suggested by Frazier, Barron, & Tix, (2004), moderator effects have the greatest power when the relationship between the predictor and outcome variables is strong. A significant correlation was present between body dissatisfaction and self-efficacy, $r(171) = -.32, p < .001$. The data met the assumptions of collinearity (BSQ, tolerance = .97, $VIF = 1.03$; MPS-Self, tolerance = .97, $VIF = 1.03$) and independent errors (Durbin-Watson value = 2.13). To predict the overall self-efficacy index from body dissatisfaction, hierarchical multiple regression analysis was conducted. Body dissatisfaction was a significant predictor of self-efficacy, $B = -0.10, t = -4.36, p < .001$, as it accounted for a significant amount of the variability in self-efficacy scores, $R^2 = .10, \text{ adjusted } R^2 = .10, F(1, 171) = 19.04, p < .001$ (see

Table 4). The linear combination of body dissatisfaction ($B = -0.11, t = -5.193, p < .001$) and self-oriented perfectionism ($B = 0.23, t = 4.24, p < .001$) also accounted for a significant proportion of the self-efficacy variability, $R^2 = .19, \text{ adjusted } R^2 = .18, F(2, 170) = 19.46, p < .001$. To evaluate the interaction between self-oriented perfectionism and body dissatisfaction, a third analysis was conducted. The interaction between BSQ and MPS-Self ($B = 0.00, t = 2.08, p = .04$) explained an additional 2% of the variance in self-efficacy, $R^2 = .21, \text{ adjusted } R^2 = .19, F(3, 169) = 14.67, p < .001$. Therefore, self-oriented perfectionism significantly moderated the relationship between body dissatisfaction and self-efficacy scores. Follow-up simple slope analysis revealed that the slope for participants with 1 *SD* below the mean of MPS-Self was statistically significant, $-0.16, p < .001$. The slope for individuals with a mean level of MPS-Self was also significant, $-0.12, p < .001$, as was the slope for participants with 1 *SD* above the mean, $-0.08, p = .005$. The associations between BSQ and GSES were gradually increased from the $M + SD, M$, and $M - SD$ MPS-Self groups. The results of simple slope analysis indicate that low self-oriented perfectionism was a factor that strengthened the association between body dissatisfaction and self-efficacy (see Fig. 3).

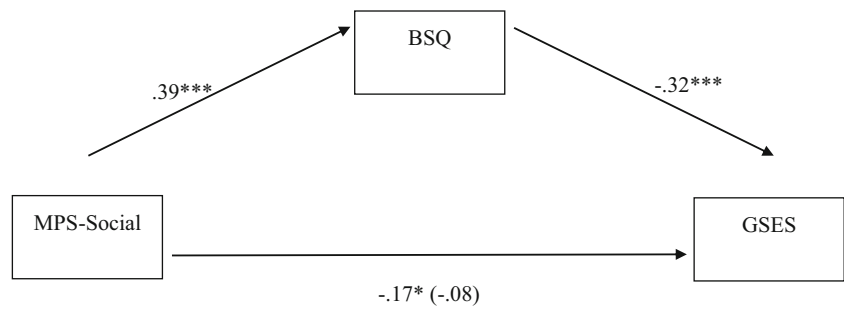
Socially-Prescribed Perfectionism Moderates Body Dissatisfaction and Self-Efficacy

The data met the assumptions for collinearity (BSQ, tolerance = .84, $VIF = 1.18$; MPS-Social, tolerance = .84, $VIF = 1.18$) and independent errors (Durbin-Watson value = 2.09). Again, hierarchical multiple regression analysis was conducted to predict the overall self-efficacy index from body dissatisfaction. The results showed that body dissatisfaction was a significant predictor of self-efficacy, $B = -0.10, t = -4.36, p < .001$, accounting for a significant amount of variance in self-efficacy, $R^2 = .10, \text{ adjusted } R^2 = .10, F(1, 171) = 19.04, p < .001$ (see Table S7 electronic supplementary material for a summary). Moreover, the linear combination of body dissatisfaction ($B = -0.09, t = -3.71, p < .001$) and socially-prescribed perfectionism ($B = -0.05, t = -0.75, p = .45$) accounted for a significant amount of the self-efficacy variability, $R^2 = .10, \text{ adjusted } R^2 = .09, F(2, 170) = 9.78, p < .001$. However, socially-prescribed perfectionism alone was not supported as a predictor of self-efficacy. The interaction between socially-prescribed perfectionism and body dissatisfaction was examined. Despite a small improvement in the model (explained an additional 1% of the variance in self-efficacy), $R^2 = .11, \text{ adjusted } R^2 = .09, F(3, 169) = 6.82, p < .001$, the interaction between BSQ and MPS-Social ($B = 0.00, t = 0.95, p = .34$) did not explain a significant amount of variance in self-efficacy, suggesting no

Table 3 Summary of Mediation Effect of BSQ on MPS-Social and GSES

	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Step 1				
Outcome: GSES				
Predictor MPS-Social	-0.14	0.06	-.17	.02
Step 2				
Outcome: BSQ				
Predictor: MPS-Social	1.06	0.19	.39	< .001
Step 3				
Outcome: GSES				
Mediator: BSQ	-0.10	0.02	-.32	< .001
Predictor: MPS-Social	-0.05	0.07	-.08	.45

Fig. 2 Standardized regression coefficients for the relationship between MPS-Social and GSES as mediated by BSQ. The standardized regression coefficient between MPS-Social and GSES, controlling for BSQ is in parentheses. *Note.* * $p < .05$, ** $p < .01$, *** $p < .001$



moderation effects. However, Robinson, Tomek, and Schumacker (2013) propose that moderation effects should be explored using simple slope analysis, which is more powerful and as such, reduces Type II error. Thus, despite the nonsignificant interaction effect, a simple slope analysis was performed. The unstandardized simple slopes suggested that people with 1 SD below the mean of MPS-Social, at the mean, and 1 SD above the mean were $-.12$, $p = .002$, $-.10$, $p < .001$, $-.07$, $p = .01$, respectively. That is, the association between body dissatisfaction and self-efficacy was strengthened as socially-prescribed perfectionism decreased, as supported by simple slope analysis (see Fig. 4).

General Discussion

Experiment 1

This experiment examined the methodology and the effectiveness of CBM-I paradigms in the induction of perfectionism. Specifically, two different CBM-I techniques were contrasted to investigate the effectiveness of the bias inductions in state self-reported and behavioural perfectionism. The results

indicate that the CBM-I induction did not successfully manipulate either measure of perfectionism; therefore, both hypotheses were not supported. The results of the experiment suggest that participants in both conditions 1 and condition 3 did not report significantly higher state perfectionism and did not display more checking behaviour on the bead-sorting task in the posttest. When conditions 1 and 3 were combined together to examine whether the two experimental groups had a higher increase in perfectionism than the combined control groups (conditions 2 and 4), the results show that the experimental groups did not differ significantly from the control groups. In other words, the current study failed to replicate Yiend, Savulich, Coughtrey, and Shafran’s (2011) study in which perfectionism was successfully induced through CBM-I training. Furthermore, participants across all the experimental and control groups had a significantly lower checking choice in the posttest. As Yiend, Savulich, Coughtrey, and Shafran (2011) had a longer delay between their pre and posttests, this finding may suggest that the bead-sorting task is not suitable for use with a short duration between pre and posttest. Similarly, it is possible that participants had more confidence in their bead sorting due to practice effects (i.e., they did not feel as

Table 4 Summary of Moderation Effect of MPS-Self on BSQ and GSES

	ΔR^2	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Step 1					< .001
BSQ	.10	-.10	0.02	-.32	< .001
Step 2					< .001
BSQ	.09	-.11	0.02	-.36	< .001
MPS-Self		0.23	0.05	.30	< .001
Step 3					< .001
BSQ	.02	-.03	0.10	-.07	.002
MPS-Self		-.05	0.15	-.99	.72
BSQ*MPS-Self		0.00	0.02	.00	.04

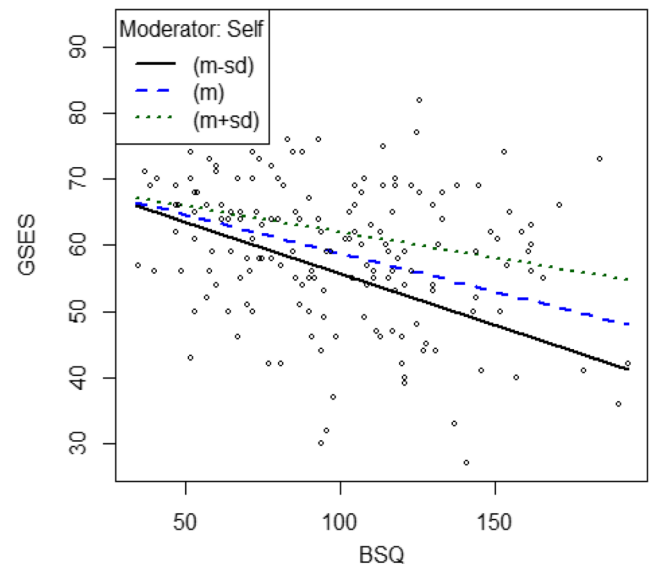


Fig. 3 Simple slope plot of the interaction between BSQ and MPS-Self on GSES. *Note.* $m - sd = 1 SD$ below M ; $m = Mean$; $m + sd = 1 SD$ above M

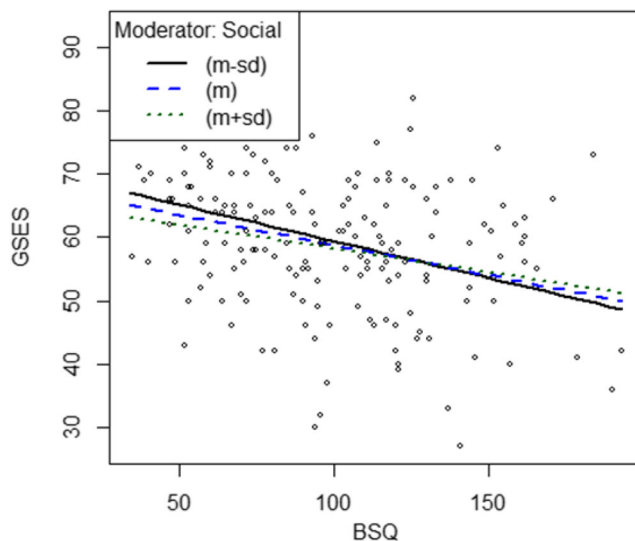


Fig. 4 Simple slope plot of the interaction between BSQ and MPS-Social on GSES. Note. $m - sd = 1$ SD below M ; $m = Mean$; $m + sd = 1$ SD above M

compelled to check their sorting after the second attempt at the task). Alternatively, the results may simply reflect participant fatigue due to the length of the initial survey. The failure to replicate Yiend, Savulich, Coughtrey, and Shafran's (2011) study may suggest that state perfectionism cannot be manipulated with a single-session CBM-I induction with less than 40 trials. As suggested by previous research, CBM-I may require at least 110 trials to produce an effect (Yang et al., 2017). Since the present study included only 30 scenarios in the CBM-I training, the effect may not have been strong enough to induce differences in perfectionism. Furthermore, it is possible that there may be additional studies that attempted but failed to replicate Yiend, Savulich, Coughtrey, and Shafran's (2011) study that remain unpublished due to publication bias. Further, the absence of a validated state perfectionism questionnaire brings into question the validity of measuring state perfectionism.

A further analysis controlling for trait perfectionism as a covariate suggests that trait perfectionism was significantly related to state perfectionism. However, state perfectionism in conditions 1 and 3 did not significantly differ in the posttest after adjusting the means. These results are in line with a previous study which found that verbal self-generation of positive interpretations for ambiguous scenarios is not more effective than the traditional CBMI-I technique in inducing a more positive mood to reduce depressive symptoms (Rohrbacher, Blackwell, Holmes, & Reinecke, 2014). Further, no significant difference in state perfectionism was found when the combined experimental and control groups were compared. This finding suggests that there might be other variables, apart from trait perfectionism, that are confounding the results of the study. For example, personality traits and academic achievement have

been associated with perfectionism (Flett, Stainton, Hewitt, Sherry, & Lay, 2012). Despite the presence of confounding variables that cannot be controlled, the endorsement of trait perfectionism in our sample was comparable to previous investigations in university samples (e.g., Shafran, Lee, Payne, & Fairburn, 2006).

Despite the lack of significant differences in the effectiveness of the CBM-I techniques in inducing perfectionism, the results of the memory tests suggest that a larger sample size may yield a detectable difference. That is, participants in the novel CBM-I group (both experimental and control) had higher, although not significant, recognition of the scenarios presented compared to participants in the traditional CBM-I group. This may suggest that the novel CBM-I task may improve the participant's engagement with the task, but the failure to manipulate state perfectionism limits our findings. The novel CBM-I technique is consistent with other lines of research that have attempted to enhance participants' attention and comprehension of the entire scenario presented (e.g., incorporating imagery tasks; Lang, Blackwell, Harmer, Davison, & Holmes, 2012), because it requires participants to comprehend and attend to the scenario as a whole (i.e., instead of focusing only on the missing letters) in order to generate an appropriate word to fit the valence of the scenario. Therefore, researchers may wish to further examine how the word-based CBM-I influences biases that have been successfully manipulated (e.g., depression and anxiety). For example, Hirsch et al.'s (2020) study found that imagery combined with self-generation inductions on 50% of the trials produced a superior effect in the modification of interpretation biases related to repetitive negative thinking. For the present study, it is also noteworthy that participants in the control groups performed significantly better in the memory test compared with participants in the experimental groups. Since the scenarios used in the control conditions were more varied (i.e., representing a wide range of activities) than those presented in the experimental conditions (i.e., representing achievement), it is possible that participants found the scenarios in the control condition to be more interesting and more relatable to daily life. Future research may benefit from incorporating more relatable and interesting scenarios as it might impact participants' engagement with the training.

Experiment 2

This study investigated the complex relationships between body dissatisfaction, self-efficacy, and specific dimensions of perfectionism. The mediation effects of body dissatisfaction on self-oriented perfectionism and self-efficacy (H1) as well as on socially-prescribed perfectionism and self-efficacy (H2) were examined. Hypothesis one was not supported as body

dissatisfaction was not found to mediate the relationship between self-oriented perfectionism and self-efficacy. This finding may be explained in two ways. First, the relationship between the predictor and the mediator ($B = 0.40$) was larger than the relationship between the mediator and outcome ($B = -.10$), which may decrease the power to detect effects. Second, as suggested by Zhao, Lynch, and Chen (2010) regarding direct-only nonmediation effects, it is possible that there are alternative or undiscovered mediators in the model.

In contrast to previous research showing that low self-efficacy is related to self-oriented perfectionism (Hart, Gilner, Handal, & Gfeller, 1998), the present study found that self-oriented perfectionism was associated with *high* self-efficacy. Results from the moderation analysis indicate that body dissatisfaction was a moderator between self-oriented perfectionism and self-efficacy. That is, high body dissatisfaction increased the association between self-oriented perfectionism and self-efficacy. In other words, individuals with high body dissatisfaction had greater self-oriented perfectionism and greater self-efficacy. Vohs, Bardone, Joiner, Abramson, and Heatherton (1999) and Vohs et al.'s (2001) found that the combination of perfectionism and body dissatisfaction leads to effective weight control in high self-esteem individuals, who may view their weight as changeable. The findings from the present study also demonstrate that the combination of self-oriented perfectionism and body dissatisfaction was associated with greater self-efficacy, but how high self-efficacy relates to maladaptive (e.g., restrictive eating, purging) or adaptive weight control strategies remain unclear. Donovan, Chew, and Penny (2014) found that high body dissatisfaction moderated the relationship between perfectionism and purging. Moreover, Boone, Soenens, and Luyten (2014) found that high personal standards perfectionism (which is inclusive of self-oriented perfectionism) combined with high body dissatisfaction results in greater drive for thinness. Therefore, it may be that perfectionistic individuals with high self-efficacy believe that they can succeed in attaining an idealized body, which leads to engagement with unhealthy weight control behaviours as a result of high body dissatisfaction. However, additional research is needed to support this hypothesis. Future research should continue to examine the underlying factors that explain why high body dissatisfaction is associated with elevated levels of self-oriented perfectionism and self-efficacy, by assessing potential mediators for the interaction between self-oriented perfectionism and body dissatisfaction (i.e., a mediated moderation; Baron & Kenny, 1986).

Next, as hypothesized, body dissatisfaction fully mediated the relationship between socially-prescribed perfectionism and self-efficacy. These findings suggest that individuals with socially-prescribed perfectionism have low self-efficacy as a result of body dissatisfaction. A strong argument can be made that socially-prescribed perfectionism preceded both body

dissatisfaction and self-efficacy. Based on the positive beta coefficient between the predictor and mediator, high socially-prescribed perfectionism predicts greater body dissatisfaction. Further, based on the negative beta coefficient between the mediator and the outcome, high body dissatisfaction relates to a reduction in self-efficacy. In contrast to previous research, which found that socially-prescribed perfectionism was related to high self-efficacy (Hart, Gilner, Handal, & Gfeller, 1998), the current results suggest that socially-prescribed perfectionism is associated with *low* self-efficacy. This discrepancy in findings may be explained by the fact that Hart, Gilner, Handal, and Gfeller (1998) did not examine body dissatisfaction or other eating disorder constructs in their study. Vohs, Bardone, Joiner, Abramson, and Heatherton (1999) and Fairburn (1995) noted that the combination of high perfectionism and low self-esteem is common in people who binge. Our study is in line with their findings, where high socially-prescribed perfectionism is strongly linked to low self-efficacy because of high body dissatisfaction. Yet, whether this interaction relates to unhealthy eating behaviours, such as binge eating, should be further unexplored. The present results suggest that socially-prescribed perfectionism acts as a risk factor for body dissatisfaction and results in low self-efficacy when body dissatisfaction is present. The finding that body dissatisfaction mediates the relationship between socially-prescribed perfectionism and self-efficacy, but not self-oriented perfectionism, is in line with previous research reporting that socially-prescribed perfectionism has more consistent correlations with eating disorder symptoms than self-oriented perfectionism (Soares et al., 2009; Peixoto-Plácido, Soares, Pereira, & Macedo, 2015). To rule out an alternative model that self-efficacy precedes body dissatisfaction, an additional model which placed self-efficacy as a mediating variable was examined. However, self-efficacy was not supported as a mediator between socially-prescribed perfectionism and body dissatisfaction. As such, future research should examine whether this mediational relationship would still exist with the addition of other related variables to the model. Furthermore, as recommended by Frazier, Barron, and Tix (2004), future explorations should consider experimentally manipulating either the predictor or outcome variable, to eliminate the possibility of co-existing alternative models.

The hypothesis that self-oriented perfectionism would moderate the association between body dissatisfaction and self-efficacy was supported. The present study found that when participants have low self-oriented perfectionism, the relationship between body dissatisfaction and self-efficacy is strengthened. Female participants with low self-oriented perfectionism had lower body dissatisfaction and higher self-efficacy. The current findings are similar to Brannan and Petrie's (2008) regression model, in which self-oriented perfectionism served as a moderator between high body dissatisfaction and anorexic symptoms (i.e., purging). Donovan,

Chew, and Penny (2014) also reported that high self-oriented perfectionists with high body dissatisfaction may engage in more purging behaviours to control weight. Based on the significant interaction effect between body dissatisfaction and self-oriented perfectionism in predicting self-efficacy in the present study, interventions reducing self-oriented perfectionism may decrease body dissatisfaction and increase self-efficacy, which may reduce symptoms of eating disorders.

Finally, the hypothesis that socially-prescribed perfectionism would moderate body dissatisfaction and self-efficacy was not supported. Despite the absence of moderation effects, simple slope analysis suggested that the unstandardized simple slope for individuals with socially-prescribed perfectionism at 1 *SD* below the mean, at the mean, and 1 *SD* above the mean were statistically significant. The relationship between body dissatisfaction and self-efficacy was strongest in participants with low socially-prescribed perfectionism. Similar to the moderating role of self-oriented perfectionism, individuals with low socially-prescribed perfectionism had lower body dissatisfaction but higher self-efficacy.

Limitations and Future Research

The findings of the present investigations should be interpreted in light of the following limitations. First, the absence of validated measures of state perfectionism make it difficult to interpret the findings from Experiment 1. Although the authors attempted to reduce measurement error by incorporating both self-report and behavioural measures to assess changes in perfectionism, both measures present challenges. For example, participants varied in their strategy for the bead-sorting task (i.e., some participants used both hands while others used only one). It is possible that using both hands resulted in a faster completion time, which may have impacted the time spent finishing and checking their bead-sorting following the task. Although the bead-sorting task has previously been used to measure checking behaviour in clinical disorders associated with perfectionism (Bouchard, Rhéaume, & Ladouceur, 1999), as well as previous research in perfectionism (Yiend, Savulich, Coughtrey, & Shafran, 2011), the validity of this task must be further explored. Another limitation relates to the sensitivity of the adapted self-report measure for state perfectionism, in that it may not be sufficiently sensitive to detect differences in pre and post-test designs. Past research also found that the relationship between perfectionism and constructs related to disordered eating varies when different measurement tools were implemented (Welch, Miller, Ghaderi, & Vaillancourt, 2009). Thus, caution is warranted when noting discrepancy in results with previous findings or when making comparisons across research. Moreover, the number of males in the present study was not sufficient to make conclusions about gender differences in CBM-I training for perfectionism. However, given

the general consensus in the literature regarding the similarity of perfectionism levels across genders (Kawamura, Hunt, Frost, & DiBartolo, 2001; Parker & Adkins, 1995), significant gender differences would not be expected and thus, the unequal numbers across genders are unlikely to have significantly influenced the present findings. It should be noted that the presence of an eating disorder was not included as an exclusion factor in the current study. Based on BSQ scores, 2.9% of the current participants fell in the range of “severe concerns” about their body shape (score > 167). As such, the present sample is likely to include some individuals with disordered eating in the clinical range and should not be considered purely a non-clinical sample. Finally, due to the ineffective CBM-I perfectionism inductions, an important limitation for Experiment 2 is the inability to explore causal relationships between perfectionism, body dissatisfaction, and self-efficacy.

More research is required to examine the construct of perfectionism, since it is a multi-dimensional paradigm. For example, future research may explore other domain-specific forms of perfectionism, such as physical appearance perfectionism (Yang & Stoeber, 2012) and to address whether it can be a measured and manipulated at the state level. Future investigations may also incorporate the novel CBM-I technique (i.e., provide a word) for inducing different constructs that have been successfully manipulated (e.g., depression and anxiety) in order to understand more about its utility. To further elucidate the relationship between perfectionism, body dissatisfaction, and self-efficacy, longitudinal studies or experimental paradigms manipulating the predictor or the outcome variable (to rule out or reduce alternative models) are essential. Future research should examine whether the mediation or moderation effects found in the present study are generalizable to other populations (e.g., clinical populations). Moreover, based on the relationship between body dissatisfaction and disordered eating (Stice & Shaw, 2002), future investigations should explore how perfectionism and self-efficacy relate to different aspects of body dissatisfaction and disordered eating. For example, body dissatisfaction may encompass different dimensions of dissatisfaction with body weight, shape, muscles, or body parts (Ricciardelli & McCabe, 2002). The present study found that body dissatisfaction explains the relationship between socially-prescribed perfectionism and low self-efficacy. As such, interventions designed to decrease body dissatisfaction may also be helpful in increasing self-efficacy among individuals high in socially-prescribed perfectionism. Further, treatments that focus on decreasing self-oriented and socially-prescribed perfectionism may potentially reduce body dissatisfaction, while enhancing one’s self-efficacy. The results of the present study suggest that perfectionism should not be examined as a single construct, as the unique dimensions of perfectionism differentially relate to other personal characteristics. These relationships serve to guide prevention and treatment strategies for various mental health conditions.

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Code Availability Not applicable.

Data Availability The data analyzed during this study are included in this article as well as in the electronic supplementary materials. The complete dataset and materials generated during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the Behavioural Research Ethics Board of the University of British Columbia Okanagan (H18–02589).

Consent to Participate Informed consent was obtained from all participants included in the study.

Consent for Publication Not applicable.

Conflict of Interest/Competing Interests All authors declare that they have no conflicts of interest.

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