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Brief guided imagery and body scanning
interventions reduce food cravings

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1 Abstract

2 Elaborated Intrusion (EI) Theory proposes that cravings occur when involuntary thoughts
3 about food are elaborated; a key part of elaboration is affectively-charged imagery. Craving
4 can be weakened by working memory tasks that block imagery. EI Theory predicts that
5 cravings should also be reduced by preventing involuntary thoughts being elaborated in the
6 first place. Research has found that imagery techniques such as body scanning and guided
7 imagery can reduce the occurrence of food thoughts. This study tested the prediction that
8 these techniques also reduce craving. We asked participants to abstain from food
9 overnight, and then to carry out 10 minutes of body scanning, guided imagery, or a control
10 mind wandering task. They rated their craving at ten points during the task on a single item
11 measure, and before and after the task using the Craving Experience Questionnaire. While
12 craving rose during the task for the mind wandering group, neither the guided imagery nor
13 body scanning group showed an increase. These effects were not detected by the CEQ,
14 suggesting that they are only present during the competing task. As they require no devices
15 or materials and are unobtrusive, brief guided imagery strategies might form useful
16 components of weight loss programmes that attempt to address cravings.

17 [203 words]

18

19

Introduction

20 Desires for food are common, everyday experiences, and are highly adaptive in
21 signalling the need to eat sufficient food to fuel activity and maintain healthy physiological
22 systems. However, when desires become intense cravings and cannot immediately be
23 satisfied, they are aversive, and when they trigger significant distress or excessive eating or
24 impair our ability to perform other important cognitive tasks, they may become highly
25 dysfunctional.

26 The Elaborated Intrusion Theory of Desire (EI Theory; Kavanagh, Andrade & May,
27 2005) explicates processes underpinning the onset, exacerbation and termination of desires
28 for appetitive targets including food. Initially, desire-related cognitions typically appear
29 spontaneous, because they are triggered by associated environmental or internal cues
30 rather than being deliberately elicited (Kavanagh et al., 2005). If other later cognitions
31 capture attention, intrusive desire-related thoughts may not be processed further
32 (Kavanagh, May & Andrade, 2009). However, if the pleasure or relief from these cognitions
33 gives them greater salience than other concurrent experiences, they are consciously
34 elaborated, further increasing their affective power. Central to the theory is that sensory
35 imagery is especially likely, and because it simulates the actual experience, it conveys a
36 stronger affective pull than other cognition and is therefore more likely and more vivid
37 when craving is intense (Kavanagh, Statham, Feeney, et al., 2012; May, Andrade, Kavanagh
38 & Hetherington, 2012; Andrade, May & Kavanagh, 2012; Statham, Connor, Kavanagh, et al.,
39 2011).

40 According to EI Theory, the elaboration of craving imagery places demands on
41 limited-capacity working memory systems, and in particular, on the visuospatial sketchpad,
42 which is required for construction of visual images (Baddeley & Andrade, 2000). Concurrent

43 tasks that require attention to other visuospatial information reduce the vividness of
44 imagery and blunt the intensity of associated craving, especially if they impose a working
45 memory load. So, Andrade, Pears, May and Kavanagh (2012) found that constructing
46 shapes from clay that was hidden behind a screen reduced craving for chocolate: This task
47 requires repeatedly comparing visual imagery about a desired product with imagery
48 constructed from tactile information, as well as co-ordination of hand movements based on
49 this imagery. Instructions to create competing, emotionally neutral imagery also reduce
50 cravings, including ones for coffee (Kemps & Tiggemann, 2009), cigarettes (May, Andrade,
51 Panabokke, & Kavanagh, 2010; Versland & Rosenberg, 2007), chocolate (Kemps &
52 Tiggemann, 2007) and other food (Harvey, Kemps, & Tiggemann, 2005; Kemps &
53 Tiggemann, 2007). In contrast, since food-related craving rarely requires auditory imagery,
54 tasks that load on the phonological loop have only weak effects at best (Kemps &
55 Tiggemann, 2007; May, Andrade, Panabokke & Kavanagh, 2010), unless they impose heavy
56 general cognitive (or 'central executive') load (Andrade et al., 2012).

57 Another approach to the management of cravings uses mindfulness (Alberts,
58 Mulkens, Sweets & Thewissen, 2010; Alberts, Thewissen & Raes, 2012), which involves
59 enhancement of non-judgemental awareness of the present moment or experience (Brown
60 & Ryan, 2003). The absence of a necessity either to control or elaborate thoughts, and an
61 attention to ever-changing experiences, join to liberate the person from entanglement in
62 rumination (Kabat-Zinn, 2003).

63 Consistent with this idea, in Berry, May, Andrade & Kavanagh (2010) people who
64 were naturally mindful had less distress in response to intrusive desire-related thoughts and
65 had lower craving than less mindful people. Similarly, Alberts et al. (2012) found that
66 people who undertook 8 weeks of mindfulness-based cognitive-behaviour therapy had

67 greater decreases in food cravings and in their eating in response to sensory cues or
68 negative emotional states than did others on a wait list. Jenkins and Tapper (2013) found
69 that people who were trying to reduce their chocolate consumption ate less chocolate when
70 following a mindfulness-based cognitive defusion strategy (seeing their thoughts as merely
71 thoughts) than a control (muscle relaxation) group, or a group who accepted chocolate
72 thoughts (by 'urge surfing', using the knowledge that urges are transient, to help with
73 resisting desires to indulge). Papies, Barsalou and Custers (2012) also found that brief
74 training in 'mindful attention', viewing thoughts as transient mental events, reduced
75 approach responses to appetitive foods.

76 Body scanning is a technique commonly used in mindfulness training, where the
77 focus of attention is consciously directed around the body, while concurrently maintaining
78 an awareness of breathing (Cropley, Ussher & Charitou, 2007). As in other mindfulness
79 exercises, the person is encouraged to attend to changing experiences without questioning,
80 suppressing or being judgemental of ones that come to mind (Kristeller & Hallett, 1999). If
81 other thoughts and emotions arise, they are noted briefly before returning attention to the
82 body.

83 While mindfulness exercises including body scanning are derived from ancient
84 Buddhist traditions, their expected effects on craving are highly consistent with EI Theory.
85 For example, the attentional demands of body scanning would reduce cognitive capacity for
86 the elaboration of craving imagery, while a focus on new, emerging experiences would
87 introduce craving-irrelevant content. Accepting desire-related thoughts rather than trying to
88 suppress them would avoid the risk that monitoring the suppression would ironically
89 provide a trigger for their occurrence (Wegner & Erber, 1992), while adopting the stance of

90 a curious bystander would blunt the affective intensity of the thoughts (and their ability to
91 maintain a cyclical elaboration of craving cognitions).

92 There are indications that body scanning may indeed help people to address food
93 cravings. A small randomised controlled trial by Alberts et al. (2010) with attendees at a
94 weight reduction program reported lower food cravings after a 7-week mindfulness-based
95 intervention where body scanning was an important component. In a more controlled
96 setting, May, Andrade, Batey, Berry & Kavanagh (2010, Experiment 2) examined the effect
97 of 10 mins of Body Scanning instructions on thoughts and craving for snack foods by
98 students who were attempting to reduce consumption of snack foods and had not eaten for
99 2 hours. Effects were compared with those from Guided Imagery and Control (mind
100 wandering) instructions. During the experimental period, Body Scanning and Guided
101 Imagery reduced concurrent thoughts about snack foods, relative to 10-min Baseline and
102 Post-task periods, but the control instructions did not. However, there were no Condition by
103 Time effects on single-item ratings of craving for snack foods that were taken at the end of
104 each period. In contrast, May, Andrade, Willoughby and Brown (2012) found that both
105 craving and thought frequency about smoking were reduced in the experimental period by
106 body scanning, relative to mind wandering. That study applied a 2-session within-subjects
107 design with smokers who were asked to abstain from smoking for 2 hours, and measured
108 craving by Factor 1 of the Questionnaire on Smoking Urges (Tiffany & Drobes, 1991), but
109 otherwise had a similar procedure to May, Andrade, Batey et al. (2010).

110 The current study attempted to address two potential reasons for the lack of effects
111 on craving for snack foods in May, Andrade, Batey et al. (2010). Firstly, it increased the
112 period of food deprivation from 2 hours to at least 9 hours (in recognition of the need to
113 induce a stronger sense of deprivation, such as we saw after abstention from smoking).

114 Secondly, it sampled craving during the baseline, experimental and post-task periods rather
115 than relying on craving assessments after completion of the instructional task (when
116 competing tasks were no longer present). The study retained the three-group Between-
117 subjects design and instructional procedures used by May, Andrade, Batey et al. (2010),
118 allowing it to examine whether body scanning had similar effects to those from a task that
119 should interfere with imagery-based aspects of craving (Guided Imagery), and whether Body
120 Scanning and Guided Imagery produced differential effects from a Mind Wandering control.

121 Method

122 **Participants**

123 Participants were recruited from Plymouth University's Psychology student pool and
124 received participation credit for their participation, which they could use in their own
125 research. The experiment was conducted in accordance with the ethical guidelines of the
126 British Psychological Society and had approval from the University's Faculty of Science and
127 Technology Ethics Committee. Ninety-eight participants (75 female, 23 male, *M* age = 20,
128 range = 18-45) took part.

129 **Assessment Instruments**

130 A *single-item craving intensity measure* (0, no craving, to 10, intense craving) was
131 used for repeated measurements during the experimental phase of the study. Before and
132 after the imagery task, the *Craving Experience Questionnaire* (CEQ; May, Andrade, Kavanagh
133 et al., submitted) was used to measure the strength of food craving (CEQ-S), and the
134 frequency of craving thoughts (CEQ-F). The CEQ-S and CEQ-F each have 10 items, over three
135 subscales measuring craving intensity, use of imagery and intrusiveness. Using data from
136 twelve studies on chocolate, other food, alcohol and cigarettes, May et al. (submitted)

137 found that the internal structure of the CEQ was robust across substances and timeframes
138 over which desires were assessed, and that internal consistencies of the total CEQ-S and
139 CEQ-F were high. CEQ-S items focused on current craving. At Baseline, participants
140 completed the CEQ-F on the frequency of cravings since they last ate: at the end of the
141 session, they rated the frequency of cravings during the session.

142 The *Eating Attitudes Test* Factor 1 (EAT26; Garner, Olmsted, Bohr & Garfinkel, 1982)
143 was used to identify whether any participants screened positive for an eating disorder,
144 while a *Brief Mindfulness Measure* (BMM; Berry et al. 2010) and an *Emotional and*
145 *Behavioural Reactions to Intrusions Questionnaire* (EBRIQ; Berry, et al. 2010) checked
146 whether levels of trait mindfulness and usual reactions to intrusive thoughts were
147 equivalent across conditions.

148 **Procedure**

149 Sessions were held between 9am and noon. Participants were asked to abstain from
150 eating since midnight the night before, so that they were food-deprived for at least 9 hours.
151 They were asked to bring a breakfast item to the session. After providing informed consent,
152 they placed their breakfast item alongside a selection of other breakfast bars on the table,
153 in order to augment their craving at Baseline. If they did not bring an item, they were
154 offered a bar to take at the end of the study. They then completed the CEQ, EAT26, BMM
155 and EBRIQ, and were asked a series of questions about when they last ate, their usual
156 breakfast habits and favourite foods, in order to reinvoke craving. The breakfast bars were
157 then covered, to reduce distractions during the session's experimental phase.

158 Random allocation to conditions controlled for Baseline CEQ-S scores by using
159 separate random sequences for those above and below the running average. All conditions
160 involved a 10-min audio recording being played through headphones, while a craving scale

161 was displayed on a computer screen. An instructional statement was heard every 20
162 seconds: This instructional frequency kept them on task, while allowing them time to
163 undertake the task between statements. A bell sounded ten times within each recording (at
164 intervals of between 38 to 80 seconds, using the same pseudo-random sequence across
165 conditions), at which points participants reported their craving on the 0-10 scale.

166 The audiotapes were the same as those used by May, Andrade, Batey et al. (2010). In
167 *Mind Wandering*, participants were instructed to think about ‘anything or
168 nothing at all’ and let their ‘mind wander wherever it will go’. In *Body Scan*, they focused on
169 specific parts of the body, starting with their toes and moving to the top of their head,
170 relaxing, while noticing and accepting thoughts. Instructions included ‘notice any sensations
171 here right now’ and ‘focus on breathing’. *Guided imagery* involved imagining a forest walk,
172 using multiple senses (e.g. ‘brightly coloured birds call from the wood’; ‘feel the path
173 beneath your feet as you travel through the wood’). The random allocation gave 33
174 participants in Mind Wandering, 34 in Body Scan and 31 in Guided Imagery.

175 At the end of the recording, participants again completed the CEQ-S and CEQ-F, were
176 debriefed and then were allowed to see and take their breakfast item.

177 Results

178 Four participants did not comply with the task requirements (two Mind Wandering
179 and two Guided Imagery), giving minimum or maximum ratings to all items on one or more
180 scales, and their data were removed from the analyses. One way ANOVA on the remaining
181 94 participants showed that the three groups (see Table 1) did not differ on Mindfulness
182 (BMM: $F(2,91) = 1.70$, $p = .19$, $\eta^2 = .04$), Reactivity (EBRIQ), eating attitudes (EAT) or baseline
183 craving (CEQ) totals (all $F_s < 1$).

184

Table 1 About Here

185

A repeated measures ANOVA on the ten single-item craving ratings obtained during

186

the imagery showed no main effect of time ($F(9,819) = 1.05, \eta^2 = .011, p = .40$) or of

187

condition ($F(1, 91) = 2.11, \eta^2 = .044, p = .13$), but a significant interaction ($F(18, 819) = 1.90, \eta^2$

188

$= .04, p = .013$), as shown in Figure 1. Follow-up ANOVAs on each group showed no effects

189

of time for the bodyscan or guided imagery groups ($F_s < 1$), but a significant effect of time for

190

the control group ($F(9,270) = 3.31, \eta^2 = .10, p = .001$). Contrasts showed significant Linear

191

($F(1,30) = 4.59, \eta^2 = .13, p = .04$) and Quadratic ($F(1,30) = 4.51, \eta^2 = .13, p = .04$) effects,

192

indicating a rise in craving over the first half of the mind wandering task, which then levelled

193

off.

194

Figure 1 About Here

195

Repeated measures ANOVA was also conducted on the before and after task totals

196

from the CEQ. There were no statistically significant effects for the scale totals or any of the

197

subscales (Figure 2), although for the CEQ-S Imagery subscale the effect of time approached

198

significance ($F(1,91) = 3.43, p = .067, \eta^2 = .04$), as did the interaction of time x condition

199

($F(2,91) = 2.39, p = .098, \eta^2 = .05$), as the mind wandering group's scores rose while the

200

other two groups' fell.

201

Figure 2 About Here

202

Discussion

203

The single item craving measures obtained during the experimental task rose for

204

participants who allowed their mind to wander, but remained constant for those in the

205 guided imagery and body scanning conditions. We have therefore extended the findings of
206 May, Andrade, Batey et al. (2010) to show that these attentional control tasks can prevent
207 the occurrence of cravings for food as well as reducing the frequency of intrusive thoughts,
208 as it did for cravings and thoughts about smoking in May et al. (2012). As in May, Andrade,
209 Batey et al. (2010), the before and after measures of craving did not show an effect,
210 suggesting that craving is only suppressed while the imagery interventions are being
211 conducted.

212 In practical terms, this research suggests that the body scanning and guided imagery
213 tasks could be helpful for people who are trying to resist the cravings that occur during
214 abstinence or reduction attempts, and which lead to relapse (Sitton, 1991; Massey & Hill,
215 2012). While body scanning is a core mindfulness technique because of its links to Buddhist
216 meditation practice and the idea that thoughts are, like physical sensations, transitory, the
217 guided imagery script used here had identical effects. In fact, many mindfulness tapes
218 available commercially also make use of a 'forest walk' script, directing the listener's
219 imagery to different sensory modalities. Guided imagery shares many facets with
220 mindfulness exercises, such as relaxation and directed mental activity, without explicitly
221 including key aspects such as thought acceptance and non-judgementalism. In our work we
222 use it as a form of comparison task to assess the contribution that body scanning has
223 beyond relaxation and the control of mental imagery, and in this study, as in May, Andrade,
224 Batey et al. (2010) and May et al. (2012), find that the two are identical in effectiveness.

225 This indicates that suppressing food related imagery during a potential craving
226 episode is the most important factor in preventing a rise in craving intensity, in line with the
227 predictions of Elaborated Intrusion Theory. An alternative explanation, of course, is that the
228 mind wandering condition, intended as a control condition, is exacerbating craving rather

229 than just allowing it to occur. Allowing the mind to wander allows any intrusive thought
230 about food to be elaborated, but it does not mean that it was elaborated using visual
231 imagery: in this experimental situation, having missed breakfast, a food related thought
232 might just be the most interesting thing to think about. Although a body of other research
233 has also shown that visual imagery is a central component of craving for a range of
234 substances (e.g., Salkovskis & Reynolds, 1994; May, Panabokke, Andrade & Kavanagh, 2004;
235 Harvey et al., 2005; Statham et al., 2011), and that visual imagery tasks can also weaken
236 craving and prevent craving developing (May, Andrade, Panabokke & Kavanagh, 2010;
237 Versland & Rosenberg 2007), further research could compare unrestricted mind wandering
238 with a mind wandering condition in which visual imagery is restricted, perhaps through a
239 visual monitoring task, or through exposure to a dynamic visual noise display (Quinn &
240 McConnell, 1996), which has been shown to interfere with craving (May et al, 2010; Kemps,
241 Tiggemann, Woods & Soekov, 2004).

242 In our research we have used recorded prompts to instruct our participants in the
243 body scanning and guided imagery, but people can learn to do both tasks without such
244 prompts. As an entirely cognitive strategy, requiring no devices or materials, taking a few
245 seconds to imagine oneself in a sensorially rich environment is an easy and practical self-
246 help technique that could form part of dietary restraint and weight-loss programmes. It is
247 unobtrusive and can be employed repeatedly, whenever needed, until the temptation has
248 passed. Knäuper, Pillay, Lacaille, McCollam & Kelso (2011) asked people to deal with
249 cravings over a four-day period by vividly imagining engaging in a favourite activity and
250 found that it reduced craving intensity, whereas three control conditions had no effect.

251 It is likely that the positive affective nature of the scenes imagined in our work and in
252 that of Knäuper et al. (2011) would motivate people to continue to use the strategy, but it

253 must also be recognised that the effects upon craving might be due more to the mood and
254 relaxation effects than to the demands of imagery and attentional control, and further work
255 should contrast these conditions with positive mood enhancement that does not include
256 these cognitive aspects. Evaluation could also usefully focus upon the need for novelty in
257 the imagined scenes, to assess the contribution of higher-order cognitive processes in the
258 generation of imagery, as opposed to the retrieval of familiar scenes from memory.

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Table 1: Means (standard deviations) for the Eating Attitudes Test (EAT), Brief Measure of Mindfulness (BMM) ,Emotional & Behavioural Reaction to Intrusions Questionnaire (EBRIQ), and baseline Craving Experience Questionnaire Strength (CEQ-S) and Frequency (CEQ-F).

Imagery Condition	N	EAT	BMM	EBRIQ	CEQ-S	CEQ-F
Control	31	7.8 (7.1)	3.1 (0.5)	2.9 (0.7)	4.4 (1.9)	4.2 (1.6)
Body Scan	34	8.5 (5.6)	2.9 (0.5)	2.7 (0.6)	4.8 (2.2)	4.2 (2.1)
Guided Imagery	29	9.0 (7.0)	3.1 (0.5)	2.7 (0.6)	4.8 (1.9)	4.3 (1.9)

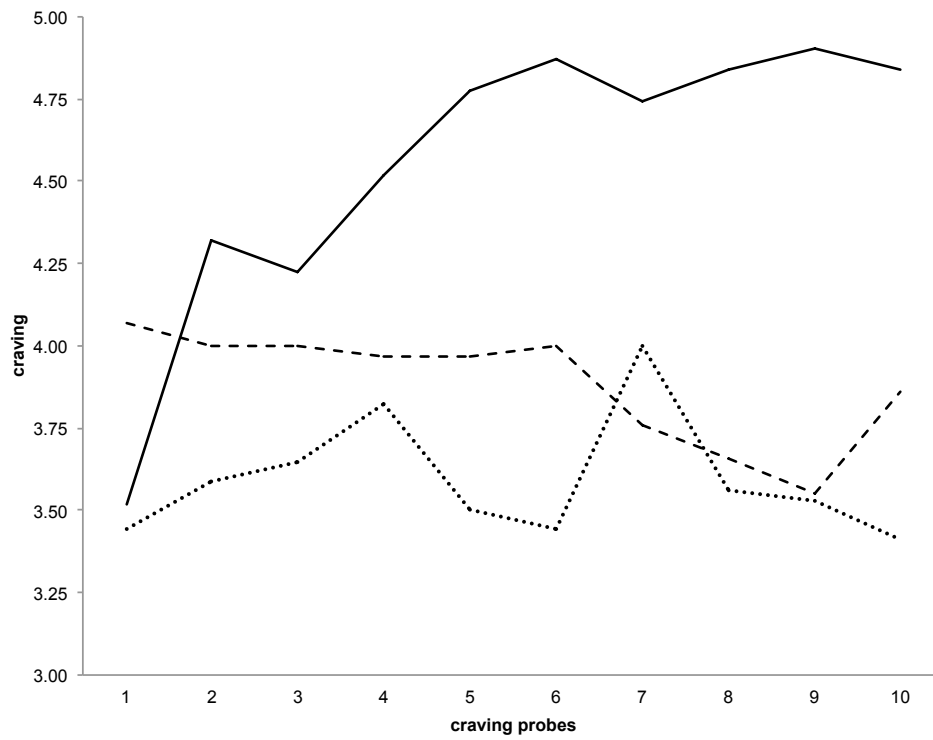


Figure 1. During the imagery tasks, craving did not change for the Body Scanning (dotted line) and Guided Imagery (dashed line) groups, but rose for the Mind Wandering control group (Solid line).

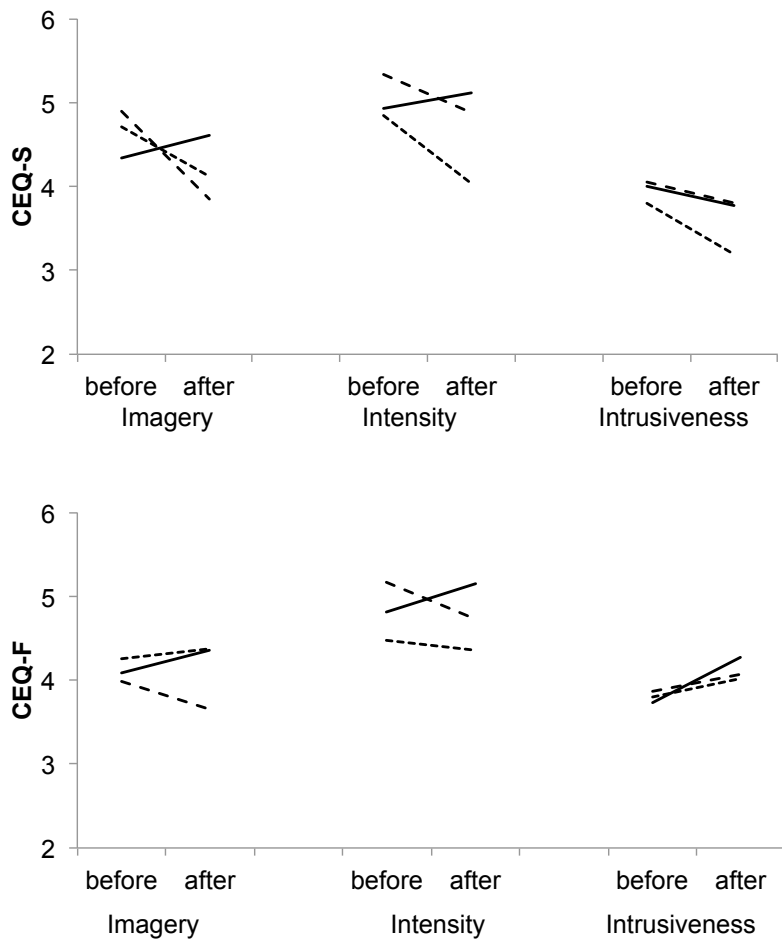


Figure 2. Although CEQ-Strength Imagery and Intensity scores declined for the Body Scan (dotted line) and Guided Imagery (dashed line) groups, compared to the Mind Wandering control group (Solid line), no interactions were statistically significant. CEQ-Frequency scores were unchanged for all three groups.