First publ. in: Elsevier Learning and Individual Differences 17 (2007), pp. 280–290

Attributional retraining and elaborative learning: Improving academic development through writing-based interventions

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Abstract

Attributional retraining (AR) is a motivational intervention that consistently produces improved performance by encouraging controllable failure attributions. Research suggests that cognitively engaging AR methods are ideal for high-elaborating students, whereas affect-oriented techniques are better for low-elaborating students. College students' ($N=749$) elaborative learning was assessed in the first semester, after which students were assigned to one of three writing-based AR conditions (No AR, Cognitive AR, Affective AR). Academic performance (course grades, GPA), motivation, attributions, and emotions were assessed in the second semester. AR by elaboration (low/high) 3×2 ANCOVAs showed optimal results for high elaborators following cognitive AR, and for low elaborators following affective AR. Performance improvements for the former were mediated by improved cognitions (expectations), and for the latter were mediated by increased positive affect.

Keywords: Attributional retraining; Affect; Elaboration

According to Weiner's (1985, 1995) attribution theory, causal attributions for success and failure have a significant impact on students' motivation, emotions, and achievement. Attributional retraining (AR) is a remedial intervention based on this premise, that assists students by encouraging controllable attributions for poor performance (Perry, Hechter, Menec, & Weinberg, 1993; Perry & Penner, 1990). While this technique has consistently produced modest increases in academic motivation and performance in college students, efforts to improve this intervention are ongoing. Specifically, recent research concerns the assessment of AR methods and the identification of student risk factors, both of which moderate the effectiveness of AR (Perry, Hall, & Ruthig, 2005). The present study examines the differential effectiveness of AR involving a cognitive or affective writing exercise for students' academic development, and the moderating effects of elaborative learning strategy use.

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doi:10.1016/j.lindif.2007.04.002

1. Attributional retraining

Weiner's (1985, 1995) attribution theory posits that uncontrollable attributions for failure are especially detrimental to student motivation. Attributing poor performance to lack of ability, for example, will likely result in feelings of hopelessness and shame, and in turn, decreased motivation, achievement striving, and test performance. To counter these developments, attributional retraining (AR) encourages controllable explanations for failure such as lack of effort or poor study strategy (for reviews, see Forsterling, 1985; Perry et al., 2005). In turn, these "modified" attributions promote greater achievement motivation and perceptions of personal control, and result in increased persistence and performance (Schunk, 1998).

AR is typically comprised of an informational session (e.g., videotape, handout) followed by a consolidation phase allowing students to elaborate on the attributional information. Consolidation exercises have included an aptitude or achievement test (Menec et al., 1994; Perry & Penner, 1990), group discussion (Perry & Struthers, 1994), or a writing exercise (Hall, Perry, Chipperfield, Clifton, & Haynes, 2006; Van Overwalle & De Metsenaere, 1990; Wilson & Linville, 1982) with specific techniques proving beneficial for specific at-risk students having poor performance, low perceived success, overly optimistic beliefs, or low perceived control. Although AR research has also involved the manipulation of consolidation methods to promote elaborative processing in at-risk groups (e.g., Haynes, Ruthig, Perry, Stupnisky, & Hall, 2006; Perry & Struthers, 1994; Ruthig, Perry, Hall, & Hladkyj, 2004; see also Perry & Magnusson, 1989), how such exercises interact with individual differences in students' use of elaborative learning strategies has only recently been explored.

2. Attributional retraining and elaborative learning

Elaborative learning is an increasingly investigated individual difference variable representing the extent to which students cognitively incorporate new information with existing knowledge. Its occurrence is typically manifested as paraphrasing, forming examples, and summarizing material in one's own words (Pintrich, Smith, & McKeachie, 1989; Pintrich & Zusho, 2002; cf., "deep learning", Entwistle, 2000). In college students, elaborative learning is positively related to achievement (Albaili, 1998; Brackney & Karabenick, 1995; Pintrich, Smith, Garcia, & McKeachie, 1993; Sadowski & Gulgoz, 1996), critical thinking (Cheung, 2000; Cheung, Rudowicz, Lang, Yue, & Kwan, 2001), and control beliefs (Brackney & Karabenick, 1995; Pintrich et al., 1993). As such, control-enhancing interventions are often recommended for students who infrequently use of elaborative learning strategies (Brackney & Karabenick, 1995; Hofer, Yu, & Pintrich, 1998).

Research exploring how individual differences in elaborative learning moderate the effectiveness of AR is encouraging. In a study by Hladkyj, Hunter, Maw, and Perry (1998), AR administered via a videotape presentation and group discussion improved course performance for high-elaborating students. A follow-up study by Hall, Hladkyj, Perry, and Ruthig (2004) evaluated an AR technique involving a videotape followed by an independently-completed exercise: a writing assignment encouraging cognitive elaboration (Entwistle, 2000), or an aptitude test fostering emotion-based reactance (Wortman & Brehm, 1975). Both low- and high-elaborating students performed better following either AR format. Further, added benefits were found on control-related cognitions for high elaborators after the cognitive AR, and on negative affect for low elaborators after the affective AR. Although this suggests that performance improvements in low vs. high elaborators were due to affective vs. cognitive changes, respectively, this interpretation is confounded by the different consolidation formats used (i.e., writing vs. aptitude test).

The present study explored the differential effectiveness of AR involving cognitive or affective elaboration for low- and high-elaborating students, and employed a consistent writing-based consolidation format (see Pennebaker & Francis, 1996; Smyth, 1998) to more clearly examine the consolidation processes hypothesized to underlie performance improvements for each group. More specifically, it was anticipated that by structuring AR to more explicitly focus on cognitive vs. affective elaboration, low elaborators would respond best to Affective AR, particularly on affect-related outcomes, whereas high elaborators would benefit most from Cognitive AR, especially on cognition-related outcomes.

3. Method

3.1. Participants

Two months into the 2001/2002 academic year, 749 students at a large, mid-western research-1 university were recruited from 11 sections of a two-semester introductory psychology course to participate in a three-phase study in exchange for experimental credit. All students designated English as their first language, and completed a battery of questionnaires at the beginning (Phase 1) and at the end (Phase 2) of the academic year concerning their university experiences, with attributional retraining conducted in Phase 1 immediately following the initial survey. The Phase 1 (October) sample consisted of 460 females and 280 males (9 students did not indicate their gender), with a mean age of 19 years and average high school grade of 76%. The Phase 2 sample was reduced by 21% (adjusted $n=593$).

3.2. Independent measures

3.2.1. Attributional retraining

AR was presented to students in one of two formats, namely via an oral/handout presentation of attributional information followed by a writing assignment including primarily cognitive or affect-oriented content. The *AR handout presentation*, identical to that used by Hall et al. (2006), was discussed by the experimenter and read by all participants (see Procedure). The one-page handout summarized the benefits of changing dysfunctional causal attributions (e.g., ability) to functional attributions (e.g., effort) and offered suggestions for more adaptive ways of thinking about failure.

The *affective writing assignment* was derived from written emotional expression research (Pennebaker, 1997; Smyth, 1998). Specifically, students described in detail a recent instance in which they performed poorly on an exam or assignment, and to elaborate on its emotional impact. Consistent with the Pennebaker paradigm, participants were explicitly informed as to the confidential nature of their written responses. It was assumed that by encouraging students to construct a coherent emotion-based narrative, the negative affect accompanying a failure experience would be incorporated into an organized linguistic structure, allowing that memory to be understood and forgotten more efficiently (Pennebaker & Seagal, 1999).

The *cognitive writing assignment* was nearly identical to that used in previous research (Hall et al., 2006) and consisted of four questions. The first three questions addressed the three tenets of elaborative processing (Entwistle, 2000): depth (i.e., interconnections fostering summarization), breadth (i.e., considering a variety of related information), and personal structure (i.e., personally relevant examples). Participants were first requested to summarize the handout presentation, then generate possible reasons for poor performance in first-year students with a specific focus on controllable factors (cf., Park & Blumberg, 2002; Weiner, 1985). The third question requested personally relevant examples of how the handout information could be applied to one's university studies. The fourth question consisted of the emotion-oriented item included in the preceding affective writing assignment.[1]

3.2.2. Elaborative learning

Students' use of elaborative learning strategies was measured in Phase 1 using a 7-point, 6-item scale adapted from Pintrich et al. (1989), e.g., "When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions" (1 = not at all true of me, 7 = very true of me; $\alpha=.84$). Students were defined as low or high elaborators using a median split: Low: $M=21.05$, SD$=4.43$, Range$=6$–27; High: $M=32.84$, SD$=3.93$, Range$=28$–42; $t(711)=38.07$, $p<.001$.[2]

3.3. Dependent measures

3.3.1. Academic achievement

Final course grades in introductory psychology were obtained from professors in Phase 3 for students who consented ($M=70.82$, SD$=13.78$, Range$=15$–100%). Overall academic performance was also assessed in Phase 3 by

[1] Each AR writing assignment encouraged both cognitive and affective elaboration based on the findings of Hall et al. (2004) showing both consolidation processes to contribute to improved performance for low- and high-elaborators. Whereas Cognitive AR primarily encouraged cognitive processing in a manner consistent with elaboration research (Entwistle, 2000), it also included an affective item based on emotive writing research (Pennebaker, 1997). Similarly, although Affective AR included a writing exercise that by nature fosters cognitive processing, students were encouraged to write only of their emotional response to failure, allowing this condition to encourage primarily affective elaboration.

[2] This domain-specific measure of elaboration was administered to a predominantly first-year college student sample during the first few weeks of classes, at which point students have little prior domain knowledge, and is considered generalizable across college courses (see Alexander, Murphy, Woods, Duhon, & Parker, 1997).

obtaining students' cumulative *grade point averages* from institutional records (4.5 = A+, 4.0 = A, 3.5 = B+, etc.; $M = 2.71$, SD = 0.91, Range = 0.24–4.50). Consistent with AR research (Hall et al., 2004, 2006), *high school grades* were included as a covariate in all analyses. For 90% of the sample, average high school grades were collected in Phase 3 from institutional records. For the remaining 10%, self-reported high school grades were obtained from Phase 1. Based on the high correlation between these measures ($r(670) = .84$, $p < .001$), a composite variable consisting of both institutional ($n = 676$) and self-report high school grades ($n = 72$) was assessed ($M = 76.23\%$, SD = 9.01, Range = 52–97%).

3.3.2. Academic motivation

Following the expectancy-value model of motivation (Weiner, 1985; Wigfield & Eccles, 2000), expectations and intrinsic motivation were measured in Phase 2. *Academic expectations* were assessed by summing together three items ($\alpha = .85$; $M = 15.90$, SD = 4.21, Range = 4–24; see Hall et al., 2006). Two 7-point items (1 = not at all true of me, 7 = very true of me) assessed global expectations for future success in introductory psychology and university, and the third 10-point item asked students their expected final grade in introductory psychology (1 = 50% or less, 10 = 92–100%). *Intrinsic motivation* was measured using a 5-item, 5-point scale adapted from Pintrich et al. (1989) and included items such as "I think that what we learn in my introductory psychology course is interesting" (1 = strongly disagree, 5 = strongly agree; $\alpha = .76$; $M = 17.49$, SD = 3.31, Range = 5–25).

3.3.3. Academic emotions

Students' positive and negative affect concerning their performance in introductory psychology were assessed in Phase 2 based on Weiner's model (1985, 1995). Each valence was measured using a 3-item, 10-point scale including one outcome-dependent and two attribution-dependent emotions (1 = not at all, 10 = very much so; see Hall et al., 2004, 2006). For *positive emotions*, students rated their feelings of happiness, pride, and hope ($\alpha = .78$; $M = 18.05$, SD = 5.64, Range = 3–30), whereas for *negative emotions*, students rated their feelings of anger, apathy, and shame ($\alpha = .59$; $M = 8.31$, SD = 4.84, Range = 3–26).

3.3.4. Causal attributions

Attributions for poor performance in introductory psychology were measured in Phase 2 on a 10-point scale (1 = not at all, 10 = very much so; see Hall et al., 2006; Haynes et al., 2006). *Controllable attributions* were assessed using a 2-item measure consisting of attributions to effort and strategy, $r(588) = .48$, $p < .001$ ($M = 14.16$, SD = 3.63, Range = 2–20). *Uncontrollable attributions* for failure were measured using a 4-item scale summing together attributions to ability, luck, course professor, and test difficulty ($\alpha = .63$; $M = 19.94$, SD = 6.42, Range = 4–40).

3.4. Procedure

Phase 1 (October) was conducted one month into the academic year to ensure that all students had received feedback on at least one course exam. Students selected a study session to attend, and either an AR or No AR (control) condition was administered during a session. In Phase 1, students were allowed 45 min to complete an initial questionnaire, after which those in a No AR session ($n = 565$) were dismissed. The present design did not provide a filler task to the control group, based on a review by Perry et al. (1993) noting no significant differences between controls who performed a filler task and those who did not.

For AR participants, the treatment was administered immediately following the Phase 1 questionnaire in the same classroom setting. Participants in both AR conditions first received an explanation of the AR handout by the experimenter, and reviewed the handout before starting the writing assignment. This informational AR phase lasted 15 min. During the consolidation AR phase, participants wrote continuously for a period of 15 min, consistent with the Pennebaker model. Those in the Cognitive AR condition ($n = 140$) completed four questions encouraging primarily cognitive processing, and those in the Affective AR condition ($n = 148$) answered a single emotion-related question. All AR participants were instructed to retain the AR handout before being dismissed. The entire AR session (presentation and consolidation) lasted approximately 30 min.

Phase 2 (March) was administered near the end of the academic year, and required students to complete a second questionnaire, after which debriefing forms were distributed and participants were dismissed. In Phase 3 (May), high school grades and cumulative GPAs were obtained from institutional records, and final grades were provided by course instructors for consenting students.[3]

4. Results

4.1. Rationale for analyses

Our analytic model assessed elaborative learning using “low” or “high” groupings based on a median split (see Method), consistent with recent elaboration research (Hall et al., 2004; Stark, Mandl, Gruber, & Renkel, 2002; see also Pintrich et al., 1989). The main analyses consisted of an elaborative learning (low, high) by attributional retraining (No AR, Cognitive AR, Affective AR) 2 × 3 analyses of covariance (ANCOVAs) on end-of-year achievement, motivation, emotion, and attribution outcomes. High school grades were included as a covariate to control for unwanted variance associated with student aptitude (see Perry et al., 2005). Consistent with Hall et al. (2004), our analyses on cumulative GPA also controlled for students’ year of study and course load.

Because of specific hypotheses for low vs. high elaborators in each AR condition, one-tailed, a priori *t*-tests were used to compare each AR condition to the No AR group for low- vs. high-elaborating students. Two-tailed post-hoc *t*-tests were used to compare the two AR conditions for low- vs. high-elaborating students when interactions were significant. Supplemental regressions were also conducted to examine potential mediators of the relationship between AR and performance for low vs. high elaborators. Means and standard deviations are shown in Table 1, and the *F*-table of ANCOVA effects is presented in Table 2.

4.2. Main analyses

4.2.1. Academic achievement

For *final course grades*, the elaboration main effect was significant, $F(1, 674) = 9.86$, $p < .01$ (see Fig. 1A), with high elaborators ($M = 73.70\%$) performing better than low elaborators ($M = 70.06\%$). A significant AR main effect was also found, $F(2, 674) = 5.35$, $p < .01$. Students in the Cognitive AR condition ($M = 73.79\%$) and Affective AR condition ($M = 72.03\%$) scored 2–3% higher than students in the No AR condition ($M = 69.82\%$). These effects were qualified, however, by a significant 2-way interaction, $F(2, 674) = 3.54$, $p < .05$. As anticipated, a priori contrasts revealed significantly higher grades for high elaborators in the Cognitive AR condition, $t(289) = 3.46$, $p < .001$, and for low elaborators in the Affective AR condition, $t(280) = 2.40$, $p < .01$, relative to their respective counterparts in the No AR condition. Post-hoc contrasts showed significantly better performance for high elaborators in the Cognitive AR condition compared to high elaborators in the Affective AR condition, $t(119) = 2.79$, $p < .01$.

A significant main effect of elaboration was also found on students’ *grade point average*, $F(1, 678) = 17.45$, $p < .001$ (see Fig. 1B), showing that high elaborators ($M = 2.88$) obtained higher GPAs than low elaborators ($M = 2.59$). The AR main and interaction effects did not reach significance. However, as found for final grades, a priori contrasts showed high elaborators in the Cognitive AR condition to have significantly higher GPAs than their counterparts in the No AR condition, $t(292) = 1.73$, $p < .05$.

4.2.2. Academic motivation

A significant elaboration main effect was observed on *academic expectations*, $F(1, 574) = 25.79$, $p < .001$ (see Fig. 2), with high elaborators ($M = 17.16$) reporting higher expectations than low elaborators ($M = 15.24$). The AR main effect on expectations was also significant, $F(2, 574) = 4.87$, $p < .01$, showing that students in the Cognitive AR condition ($M = 16.56$) and Affective AR condition ($M = 16.51$) reported greater expectations than those in the No AR condition ($M = 15.52$). Further, a priori contrasts found significantly higher expectations for high elaborators in both AR

[3] In terms of procedural fidelity, each experimental session was monitored by a lead researcher, and at least two assistants. The lead researcher provided announcements, responded to questions concerning logistics, verbally restated the AR handout information, and ensured basic study procedures were followed. Research assistants were involved in the distribution and collection of materials, responding to student questions concerning logistics, record keeping, and adherence to treatment protocols. All researchers ensured there was no discussion between students, and that written responses were provided by all AR participants. Although all researchers had some undergraduate education in psychology, the intervention was structured to require no special training, elaboration, or coaching of supervisory personnel.

Table 1
Means and standard deviations for study variables

Measure	Control				Cognitive AR				Affective AR			
	Low EL		High EL		Low EL		High EL		Low EL		High EL	
	M	SD	*M*	SD	*M*	SD	*M*	SD	*M*	SD	*M*	SD
Final course grade	67.93	12.87	71.71	13.68	69.83	15.92	77.75	10.95	72.43	11.58	71.64	16.45
Grade point average	2.61	0.86	2.80	0.86	2.57	1.09	2.98	0.87	2.61	0.82	2.86	1.00
Expectations	14.63	4.34	16.40	3.83	15.53	4.14	17.60	4.15	15.55	3.80	17.47	3.90
Intrinsic motivation	16.04	3.19	18.37	3.05	16.67	2.94	18.85	3.44	17.33	3.13	18.88	2.77
Positive emotions	16.31	5.58	18.97	5.66	17.67	5.23	20.22	4.48	18.18	5.03	18.98	6.06
Negative emotions	9.63	5.06	7.75	4.51	9.52	5.70	6.13	3.66	8.04	4.82	6.82	3.76
Controllable attributions	13.49	3.46	14.93	3.41	14.60	3.33	15.00	3.61	13.69	3.74	13.08	4.25
Uncontrollable attributions	20.32	5.87	20.95	6.59	20.43	6.78	17.59	6.70	18.28	5.91	18.78	6.85

Note. AR = attributional retraining; EL = elaborative learning. Means evaluated with high school grade as covariate; GPA means also evaluated with year of study and course load as covariates.

conditions relative to controls (Cognitive AR: $t(242)=2.12$, $p<.05$; Affective AR: $t(238)=1.85$, $p<.05$). Although a similar trend was found for low elaborators, a priori contrasts were not significant (Cognitive AR: $t(233)=1.41$, $p=.08$; Affective AR: $t(238)=1.52$, $p=.06$).

Significant main effects for elaboration, $F(1, 568)=40.97$, $p<.001$, and AR, $F(2, 568)=3.83$, $p<.05$, were observed on *intrinsic motivation*. High elaborators ($M=18.70$) reported greater intrinsic motivation than low elaborators ($M=16.68$). The AR main effect showed participants in the Cognitive AR condition ($M=17.76$) and Affective AR condition ($M=18.10$) to report greater motivation relative to controls ($M=17.21$). However, a priori contrasts found significantly higher motivation relative to controls only for low elaborators in the Affective AR condition, $t(233)=2.53$, $p<.01$.

4.2.3. Academic emotions

The elaboration main effect on *positive emotions* was significant, $F(1, 575)=13.59$, $p<.001$, with high elaborators ($M=19.39$) reporting more positive affect than low elaborators ($M=17.39$). The AR main effect on positive emotions did not reach significance, $F(2, 575)=2.89$, $p=.06$. Although positive emotions were significantly higher for high elaborators in the Cognitive AR condition relative to controls, $t(245)=1.52$, $p=.06$, a priori contrasts showed significantly greater positive affect relative to controls only for low elaborators in the Affective AR condition, $t(236)=2.13$, $p<.05$. Significant main effects for elaboration, $F(1, 566)=20.74$, $p<.001$, and AR, $F(2, 566)=3.54$, $p=.05$, were found for *negative emotions* (see Fig. 3). High elaborators ($M=6.90$) reported less negative affect than low elaborators ($M=9.06$). Further, participants in both the Cognitive AR condition ($M=7.83$) and Affective AR condition

Table 2
F-table of main and interaction effects

Measure	MSE	*df*	Elaborative learning (EL)		Attributional retraining (AR)		EL × AR	
			MS	*F*	MS	*F*	MS	*F*
Final course grade	144.65	674	1426.33	9.86**	774.52	5.35**	512.34	3.54*
Grade point average	0.50	678	8.81	17.45**	0.23	0.45	0.51	1.02
Expectations	14.05	574	362.28	25.79**	68.35	4.87**	0.99	0.07
Intrinsic motivation	9.68	568	396.75	40.97**	37.05	3.83*	5.86	0.61
Positive emotions	29.24	575	397.29	13.59**	84.54	2.89	35.41	1.21
Negative emotions	21.73	566	450.65	20.74**	76.94	3.54*	31.28	1.44
Cont. attributions	12.47	573	16.31	1.31	50.56	4.06*	45.66	3.66*
Uncont. attributions	40.18	570	31.89	0.79	232.13	5.78**	117.70	2.93*

Note. Cont. = controllable; Uncont. = uncontrollable. Evaluated with high school grade as covariate; GPA also evaluated with year of study and course load as covariates.
$^*p\leq.05$. $^{**}p\leq.01$.

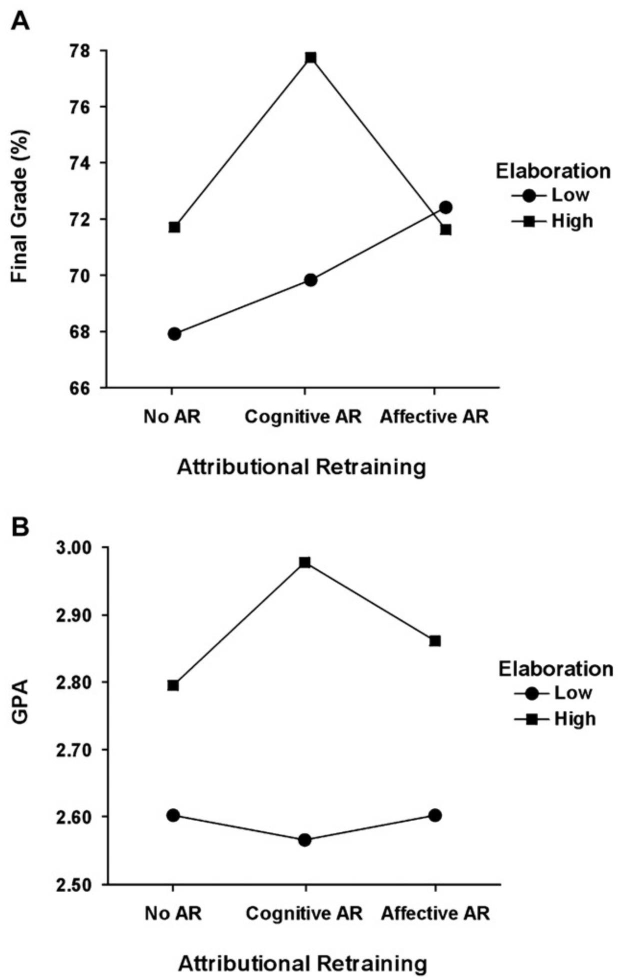

Fig. 1. Attributional Retraining (AR) by elaborative learning for academic achievement. Panel A: final course grade (%). Panel B: grade point average.

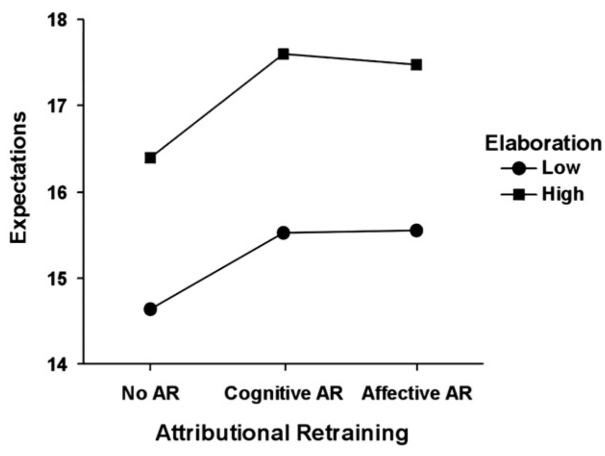

Fig. 2. Attributional Retraining (AR) by elaborative learning for academic expectations.

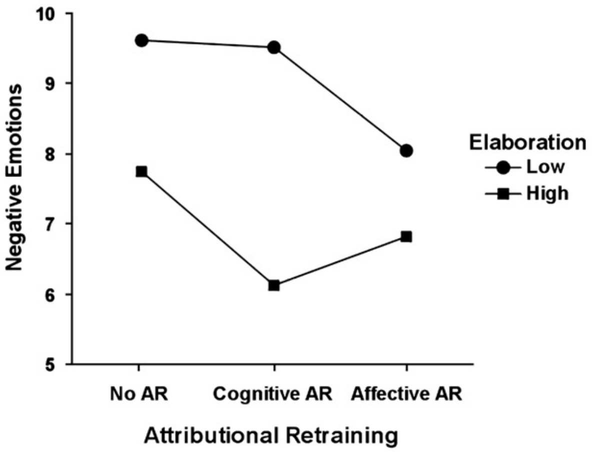

Fig. 3. Attributional Retraining (AR) by elaborative learning for negative emotions.

(M = 7.43) had lower negative affect relative to controls (M = 8.69). A priori contrasts showed significantly lower negative affect for high elaborators in the Cognitive AR condition, $t(240) = 2.27$, $p < .05$, and low elaborators in the Affective AR condition, $t(234) = 2.08$, $p < .05$, relative to their respective counterparts in the No AR condition.

4.2.4. Causal attributions

A significant main effect of AR on *controllable attributions* was observed, $F(2, 573) = 4.06$, $p < .05$, showing an intriguing pattern of results. Whereas controllable attributions were higher in the Cognitive AR condition (M = 14.80) relative to the No AR condition (M = 14.21), controllable attributions were *lowest* in the Affective AR condition (M = 13.38). This effect was qualified by a significant 2-way interaction on controllable attributions, $F(2, 573) = 3.66$, $p < .05$. A priori contrasts showed this interaction to be due to significantly *higher* controllable attributions for low elaborators in the Cognitive AR condition, $t(233) = 1.84$, $p < .05$, and significantly *lower* controllable attributions for high elaborators in the Affective AR condition, $t(239) = 3.38$, $p < .001$, relative to their respective counterparts in the control condition. Post-hoc contrasts for high elaborators found significantly lower controllable attributions in the Affective AR condition relative to the Cognitive AR condition, $t(108) = 2.85$, $p < .01$. Contrary to expectations, controllable attributions for high elaborators in the Cognitive AR condition, and low elaborators in the Affective AR condition, were not significantly different from their respective counterparts in the No AR condition.

The AR main effect was also significant for *uncontrollable attributions*, $F(2, 570) = 5.77$, $p < .01$ (see Fig. 4), with students in the Cognitive AR condition (M = 19.01) and Affective AR condition (M = 18.53) reporting lower

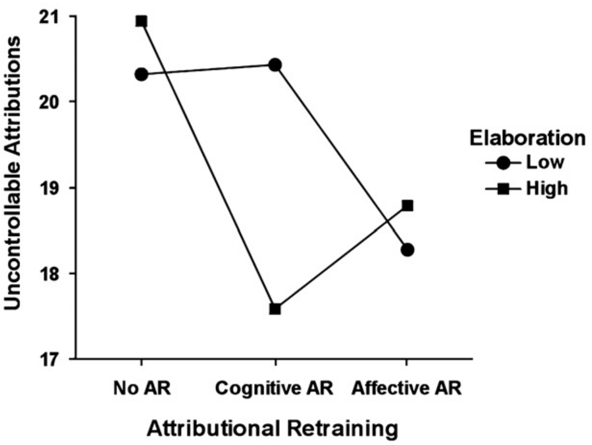

Fig. 4. Attributional Retraining (AR) by elaborative learning for uncontrollable failure attributions.

uncontrollable attributions than controls ($M = 20.63$). The 2-way interaction on uncontrollable attributions was significant, $F(2, 570) = 2.93$, $p = .05$, with a priori contrasts showing high elaborators in the Cognitive AR condition, $t(242) = 3.49$, $p < .001$, and to a lesser extent, the Affective AR condition, $t(239) = 2.20$, $p = .01$, to have lower uncontrollable attributions relative to controls. A priori contrasts also found that low elaborators in the Affective AR condition, $t(236) = 2.00$, $p < .05$, reported lower uncontrollable attributions than their counterparts in the control condition. Further, post-hoc contrasts showed the Affective AR condition to result in significantly lower uncontrollable attributions than the Cognitive AR condition for low elaborators, $t(87) = 1.60$, $p = .05$.

4.3. Supplemental mediation analyses

To further examine the consolidation processes underlying significant performance improvements for low and high elaborators, mediational regressions were conducted (see Baron & Kenny, 1986). As improved performance was found for high elaborators after Cognitive AR, and for low elaborators after Affective AR, separate analyses were conducted examining only these respective AR conditions for the low/high elaboration groups. High school grades were included as a covariate, with analyses on GPA also controlling for year of study and course load.

For high elaborators, mediation analyses on GPA were not conducted because the effect of Cognitive AR did not reach significance, $\beta = .08$, $p = .077$. Nonetheless, regression analyses did show Cognitive AR to positively predict final grades ($\beta = .18$, $p < .001$), expectations ($\beta = .13$, $p < .05$), negative emotions ($\beta = -.16$, $p < .05$), and uncontrollable attributions ($\beta = -.20$, $p < .01$). When all potential mediators were evaluated competitively, controlling for Cognitive AR, only two variables predicted final grades: expectations ($\beta = .52$, $p < .001$) and negative emotions ($\beta = -.14$, $p = .01$; non-significant mediator omitted). Sobel's (1982) z-tests found only expectations ($z = 2.13$, $p < .05$) to significantly mediate the effect of Cognitive AR on final grades for high elaborators.

For low elaborators, regressions found Affective AR to predict higher final grades ($\beta = .14$, $p = .01$), intrinsic motivation ($\beta = .16$, $p = .01$), positive emotions ($\beta = .14$, $p < .05$), negative emotions ($\beta = -.13$, $p = .05$), and uncontrollable attributions ($\beta = -.14$, $p < .05$). Two variables significantly predicted final grades when evaluated competitively and controlling for Affective AR: positive emotions ($\beta = .24$, $p < .001$) and negative emotions ($\beta = -.16$, $p < .05$; non-significant mediators omitted). Sobel's (1982) z-tests found only positive emotions ($z = 1.93$, $p = .05$) to significantly mediate the effect of Affective AR on final grades for low elaborators.

5. Discussion

The present findings replicate those of recent AR research, in demonstrating improved academic development for both low- and high-elaborating students after writing-based attributional retraining. As anticipated, significant improvements in cumulative and course-specific academic performance (i.e., B to B+) were found for high-elaborating students only when encouraged to elaborate on the attributional presentation in a cognitive manner. The Cognitive AR format also contributed to optimal levels on all outcomes for high elaborators, with significant treatment effects found for expectations, negative affect, and uncontrollable attributions. In addition, only improved cognitions (i.e., expectations) were found to significantly mediate the effects of Cognitive AR on performance for high elaborators, highlighting the underlying cognitive consolidation processes and effectiveness of cognition-oriented AR for students who frequently use elaborative learning strategies.

Consistent with our hypotheses, a significant improvement in course performance was also observed for low-elaborating students (i.e., C+ to B), albeit only when encouraged to elaborate on the emotional relevance of the AR presentation. The Affective AR method also contributed to unique improvements in intrinsic motivation, positive and negative emotions, and uncontrollable attributions for low elaborators. Furthermore, positive affect was the only variable found to significantly mediate the effects of Affective AR on final grades for low-elaborating students, illustrating the importance of allowing students who infrequently use elaborative learning strategies an opportunity to consider the emotional impact of failure-related attributions, and as a result, perform better in the classroom.[4]

[4] Two unexpected findings were observed. First, although Cognitive AR improved controllable attributions in low elaborators, this cognitive change did not translate into performance gains likely because these students do not tend to elaborate abstractly and may not have applied their attributions to their study behavior. Second, high elaborators reported lower uncontrollable *and* controllable attributions after Affective AR, suggesting an overall decline in causal search and less cognitive processing of AR information. Nevertheless, Affective AR did not negatively affect performance for high-elaborating students.

This study also underscores elaborative learning as a critical individual difference variable in AR research. First, elaborative learning resembles a typical risk factor in that low elaborators have a poorer academic profile than high elaborators. However, the finding that high elaborators are *more* likely to benefit from AR (i.e., on course grades *and* GPA) is unlike previous results for "non-risk" groups (e.g., Menec et al., 1994), and indicates that although low elaborators applied the AR principles to a single course, high elaborators applied them more broadly to their university studies. This suggests that elaborative learning is best understood not only as an academic risk factor, but also a more complex individual difference variable moderating the effectiveness of AR. In summary, the present study represents a replication and extension of recent AR research, highlighting the effectiveness of writing-based intervention methods for improving academic development in college students, and further, the importance of administering AR methods that compliment students' use of elaborative learning strategies.

Acknowledgments

This study was supported by a doctoral and post-doctoral fellowship to the first author and research grants to the second author from the Social Sciences and Humanities Research Council of Canada (410-99-0435, 410-2003-0059). The assistance of the Motivation and Academic Achievement (MAACH) Research Group was invaluable in the collection of the data. Parts of the research were presented at the annual meeting of the Western Psychological Association in Vancouver, BC, Canada, May 2003. Please address correspondence to Nathan C. Hall, Department of Psychology and Social Behavior, University of California, Irvine, Social Ecology II, Irvine, CA, 92697-7085. E-mail: halln@uci.edu. MAACH website: http://www.umanitoba.ca/faculties/arts/psychology/maach/.

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