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Allen, MS, El-Cheikh, S and Turner, MJ  (2017) A longitudinal investigation of irrational beliefs, hedonic balance and academic achievement. *Learning and Individual Differences*, 58. pp. 41-45. ISSN 1041-6080

**DOI:** <https://doi.org/10.1016/j.lindif.2017.07.003>

**Publisher:** Elsevier

**Version:** Accepted Version

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Running head: IRRATIONAL BELIEFS AND HEDONIC BALANCE

A longitudinal investigation of irrational beliefs, hedonic balance and academic achievement

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**Manuscript type:** Short report

**Word count:** 4690 (including title page, abstract, main text, references, and tables)

**References:** 30

**Tables:** 2

**Date of submission:** 6<sup>th</sup> January 2017

A longitudinal investigation of irrational beliefs, hedonic balance and academic achievement

(short report)

### **Abstract**

This investigation tested (linear and non-linear) cross-sectional and cross-time associations between irrational beliefs, hedonic balance and academic achievement. In total, 175 undergraduate students ( $M_{\text{age}} = 20.23 \pm 5.06$  years) completed measures of irrational beliefs and hedonic balance at mid-semester and again before their end of semester examinations. Student academic grades were obtained from a university electronic management package. Results showed that higher levels of irrational beliefs (depreciation) were associated with a more negative affective state at mid-semester and increases in negative affect (relative to positive affect) over time. Increases in irrational beliefs (depreciation and awfulising) also coincided with increases in negative (relative to positive) affect. Irrational beliefs and hedonic balance were unrelated to academic performance. In short, this study provides evidence that irrational beliefs are important for change in student affect over time, but that irrational beliefs and hedonic balance are unimportant for objectively measured academic achievement.

**Keywords:** Positive affect; negative affect; academic performance; rational emotive behaviour therapy

## A longitudinal investigation of irrational beliefs, hedonic balance and academic achievement

### 1. Introduction

There is considerable practical and well as theoretical value in identifying factors that contribute to academic performance. Among member countries of the Organisation for Economic Cooperation and Development, an average of 5.2% of gross domestic product is spent on education (primary to tertiary), and continuation has increased substantially with 42% of 25-34 years olds having completed tertiary education – much higher than 55-64 year olds at 26% (Organisation for Economic Cooperation and Development, 2016). Higher levels of educational attainment is associated with higher employment rates (and lower unemployment rates), better reported health, a reduced incidence of physical limitations, and higher reported life satisfaction (Organisation for Economic Cooperation and Development, 2016). Given the positive outcomes associated with higher educational attainment, identifying factors that contribute to increments in academic success is of critical importance. In this investigation we explore cross-sectional and cross-time associations between irrational beliefs, hedonic balance, and objectively measured academic performance among students in the early phase of tertiary education.

This investigation is grounded within the framework of rational emotive behaviour therapy (REBT). REBT is a cognitive-behavioural psychotherapeutic approach that was first applied to the treatment of clinical disorders (Ellis, 1957). REBT holds that it is not events that directly cause affective states, but rather, it is beliefs about those events that lead to the experience of positive or negative affect. Rational beliefs are flexible, non-extreme, and logical whereas irrational beliefs are rigid, extreme, and illogical. Both rational and irrational beliefs can be categorised into four main dimensions. Rational beliefs comprise a primary belief (preferences) and three secondary beliefs derived from the primary belief (anti-awfulizing, high frustration tolerance, and self/other acceptance). Irrational beliefs also

comprise a primary belief (demandingness) and three secondary beliefs derived from the primary belief (awfulizing, low frustration tolerance, and self/other depreciation). Irrational beliefs are at the heart of REBT and are considered the core reason for human misery and dysfunction (Dryden & Branch, 2008; Ellis & Dryden, 1997). Moreover, irrational beliefs are proposed to lead to a greater experience of negative affect.

Much research has demonstrated that irrational beliefs are associated with a greater experience of negative emotions (for reviews, see Bridges & Harnish, 2010; Visla, Fluckiger, Grosse Holtforth, & David, 2015). In student populations, cross-sectional research has demonstrated that irrational beliefs are associated with the experience of more negative emotions (David, Schnur, & Belloiu, 2002; Malouff, Schutte, & McClelland, 1992). A prospective study of undergraduate students also found that irrational beliefs measured at mid-term were associated with distress measured both concurrently and immediately prior to an exam (DiLorenzo, David, & Montgomery, 2007). However, as far as we are aware, research has not explored how irrational beliefs *for* academic achievement (e.g., “It would be catastrophic if I did not perform well in this exam”) relate to the experience of positive or negative affect. This is important as negative affect has consistently been linked to poor academic achievement (Callaghan & Papageorgiou, 2014; Chapell et al., 2005; Pekrun, Goetz, Titz, & Perry, 2002).

In line with the notion that irrational beliefs should lead to unconstructive behaviours (Ellis, 1957), researchers have explored whether irrational beliefs are harmful to performance across a variety of settings (for a review, see Turner, 2016). Surprisingly, we were unable to identify any research that had explored associations between irrational beliefs and academic performance. Nevertheless, there is some evidence that REBT (in which irrational beliefs are challenged and replaced with rational beliefs) can improve academic grades. A meta-analysis of five studies (seven effect sizes) found that REBT was associated with greater increases in

grade point average compared to non-intervention control conditions (Gonzalez, Nelson, Gutkin, Saunders, Galloway, & Shwery, 2004). However, two of the five studies found no difference between REBT and control groups, suggesting that further research is warranted. Moreover, the extant research has not sufficiently examined the relationships between irrational beliefs and academic performance. It has been suggested that some level of irrational thinking could be helpful to performance in some acute circumstances (Turner, 2016; Turner & Barker, 2014). Irrational beliefs could suggest to the individual that more effort is required (to avoid failure) leading to some adaptive behaviours (e.g., increased study time). Given this possibility, we also test whether the relationship between irrational beliefs and academic achievement is curvilinear in nature.

If irrational beliefs do relate to academic performance, from an REBT perspective it should be through the emotional (and associated behavioural) consequences of irrational beliefs (Ellis & Dryden, 1997). Therefore, it is important to examine affect when attempting to understand the role of irrational beliefs in academic performance. In this investigation we conceptualise positive and negative affect as hedonic balance (the relative amount of positive affect to negative affect). Similar to previous research (DiLorenzo et al., 2007) we test for concurrent associations and cross-time associations, with irrational beliefs and hedonic balance assessed at mid-semester and prior to student examinations. Based on the REBT framework (Ellis, 1957), we hypothesised that (1) irrational beliefs would be negatively associated with concurrently measured hedonic balance and increases in hedonic balance over time, (2) that decreases in hedonic balance will coincide with increases in irrational beliefs, (3) that higher levels of irrational beliefs and hedonic balance – and increases in irrational beliefs and hedonic balance over time – would be associated with poorer academic achievement, and (4) that hedonic balance would mediate a negative association between irrational beliefs and academic achievement.

## 2. Method

### 2.1 Participants

Data were collected from a university sample at mid-semester (Time 1) and at the end of the semester – six weeks later (Time 2). A total of 203 undergraduate students (33 men, 170 women) agreed to take part at Time 1 ( $M_{\text{age}} = 20.32 \pm 5.05$  years). At Time 2, 28 participants did not return resulting in a final sample of 175 participants, and an attrition rate of 16.0%. Compared to those that returned at Time 2, study dropouts had lower levels of hedonic balance at Time 1,  $t(201) = 2.41, p = .017$ . All other measured variables did not differ between included participants and dropouts. For the final sample, there were 30 men and 145 women aged between 17 and 51 years ( $M_{\text{age}} = 20.23 \pm 5.06$  years).

### 2.2 Measures

**2.2.1 Irrational beliefs.** The Irrational Performance Beliefs Inventory (iPBI; Turner et al., 2017) is a 28-item self-report scale that measures the four core dimensions of irrational beliefs: primary irrational beliefs (e.g., “I must not be dismissed by my peers”), low-frustration tolerance (e.g., “I can’t bear not succeeding in things that are important to me”), awfulizing (e.g., “It’s awful if others do not approve of me”), and depreciation (e.g., “If others think I am no good at what I do, it shows I am worthless”). Participants were asked to rate the 28 statements as they relate to their university education. Because the measure was not developed exclusively for an academic context, item 15 (“I need my manager/coach to act respectfully towards me”) was changed to “I need my lecturer/peers to act respectfully towards me.” Responses were provided on a five-point scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The iPBI has demonstrated construct, concurrent and predictive validity in achievement contexts (Cunningham & Turner, 2016; Turner et al., 2017). Internal consistency coefficients (Cronbach’s alpha) at Time 1 and Time 2 were .71 and .77 (primary



irrational beliefs), .78 and .81 (low-frustration tolerance), .78 and .78 (awfulising), and .87 and .92 (depreciation).

**2.2.2 Hedonic balance.** The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item self-report scale that measures two dimensions: positive affect (10 items; e.g., “excited”) and negative affect (10 items; e.g., “distressed”). Participants were asked to rate the extent to which they experienced each emotion over the past seven days. Scores are provided on a five-point scale from 1 (*very slight or not at all*) to 5 (*extremely*). The PANAS has shown evidence of test-retest reliability, in addition to construct, convergent and discriminant validity (Crawford & Henry, 2004; Watson et al., 1988). Hedonic balance was computed by subtracting the total negative affect score from the total positive affect score (see Allen, Magee, & Vella, 2016; Schimmack, Radhakrishnan, Oishi, Dzokoto, & Ahadi, 2002). Internal consistency coefficients for positive affect were .88 (Time 1) and .90 (Time 2), and for negative affect were .87 (Time 1) and .86 (Time 2).

**2.2.3 Academic achievement.** Student academic grades for the semester were obtained from a university electronic management package. Academic achievement was computed as the average of all grades obtained over the semester, expressed as a percentage.

### 2.3 Procedure

Ethical approval was granted from a university research ethics committee prior to the study. Undergraduate students completing their first semester of tertiary education were eligible for inclusion in the study. All participants provided written informed consent to participate in the study, and for the researchers to access their grades, before completing the first set of questionnaires at Time 1. Participants completed measures of irrational beliefs and affect at both Time 1 and Time 2. The decision to measure baseline scores at mid-semester was based on prior recommendations (DiLorenzo et al., 2007). At mid-semester,

students are assumed to have adjusted into their academic routines and stress levels are generally low. However, at the end of the semester, and in the week before final exams, stress levels are assumed to be high (DiLorenzo et al., 2007). Reminder emails were sent to students at Time 2 in order to maximise student retention.

## 2.4 Analyses

To explore associations between irrational beliefs and hedonic balance, we tested models that correspond to cross-sectional, longitudinal, and change associations. For cross-sectional associations (Model 1), we regressed Time 1 hedonic balance on Time 1 irrational beliefs (primary irrational beliefs, low-frustration tolerance, awfulizing, and depreciation), controlling for participant age and gender. For longitudinal associations (Model 2), we regressed Time 2 hedonic balance on Time 1 irrational beliefs (primary irrational beliefs, low-frustration tolerance, awfulizing, and depreciation), the change in irrational beliefs between Time 1 and Time 2 (Time 1 scores subtracted from Time 2 scores), again controlling for participant age and gender. For change associations (Model 3), we computed the same regression model as Model 2 with Time 1 hedonic balance held constant.

We then tested whether irrational beliefs predicted academic achievement, by re-running Model 2 with academic achievement included in place of hedonic balance. Next, we tested whether hedonic balance at Time 1, and the change in hedonic balance between Time 1 and Time 2, predicted academic achievement, again controlling for participant age and gender. In our final models, we tested for a potential curvilinear relationship between irrational beliefs and academic achievement. Quadratic terms for irrational beliefs were computed from standardised data and entered alongside linear terms and covariates, with academic achievement set as the dependent variable. There were no missing cases in the dataset, and all variables showed normal distributions (skewness values  $< \pm 1.00$ ). For all regression models, there was no evidence of multicollinearity (VIF values  $< 5.00$ ) and no

multivariate outliers (Cook's distance values  $< .10$ ). Normality of residuals was confirmed through visual inspection of normal probability plots (standardised residuals against predicted values).

### 3. Results

Table 1 provides means, standard deviations and bivariate correlations for study variables. Findings from the linear regression models for irrational beliefs and hedonic balance are reported in Table 2. In Model 1, there was a significant negative association between depreciation and hedonic balance at Time 1, demonstrating that participants reporting more irrational beliefs related to self-worth tended to report a more negative affective state. In Model 2, depreciation at Time 1 and the change in depreciation between Time 1 and Time 2 had a negative association with Time 2 hedonic balance. The negative regression coefficients indicate that greater feelings of worthlessness at Time 1 and increases in these feelings over time were related to a more negative affective state at the end of the semester. In Model 3, depreciation at Time 1 and the change in depreciation and awfulising between Time 1 and Time 2 were negatively associated with change in hedonic balance. The negative regression coefficients demonstrate that higher levels of depreciation at Time 1, and increases in depreciation and awfulising between Time 1 and Time 2, were associated with decreases in positive (relative to negative) affect.

For objective performance scores, irrational beliefs at Time 1 (Step 2,  $\Delta F_{(4, 167)} = 2.28$ ,  $p = .063$ ,  $\Delta R^2 = .05$ ) and the change in irrational beliefs between Time 1 and Time 2 (Step 3,  $\Delta F_{(4, 163)} = 0.66$ ,  $p = .624$ ,  $\Delta R^2 = .01$ ) were unrelated to academic achievement. Hedonic balance at Time 1 (Step 2,  $\Delta F_{(1, 170)} = 0.60$ ,  $p = .442$ ,  $\Delta R^2 = .00$ ) and the change in hedonic balance between Time 1 and Time 2 (Step 3,  $\Delta F_{(1, 169)} = 0.73$ ,  $p = .396$ ,  $\Delta R^2 = .00$ ) was also unrelated to academic achievement. For curvilinear relationships, after controlling for covariates (Step 1) and linear terms (Step 2), quadratic terms for irrational beliefs at Time 1

( $\Delta F_{(4, 163)} = 0.26, p = .905, \Delta R^2 = .01$ ) and Time 2 ( $\Delta F_{(4, 163)} = 0.57, p = .684, \Delta R^2 = .01$ ) were unrelated to academic achievement. These findings demonstrate that student irrational beliefs and affective states were unimportant for objectively measured academic achievement.

#### 4. Discussion

This study examined interrelationships between irrational beliefs, hedonic balance, and academic achievement in an undergraduate sample. Supporting study hypotheses, greater levels of irrational beliefs (depreciation) were associated with a more negative affective state at mid-semester and increases in negative affect (relative to positive affect) over time. Also supporting study hypotheses, increases in irrational beliefs over time (depreciation and awfulising) coincided with increases in negative affect (relative to positive affect). Findings did not support the hypothesis that irrational beliefs and hedonic balance would relate to academic performance and, in turn, that hedonic balance would mediate a negative association between irrational beliefs and academic performance. In addition, findings showed that irrational beliefs did not relate to academic performance in a curvilinear manner. Overall, the study provides evidence that irrational beliefs regarding academic achievement are important for change in hedonic balance over time, but that irrational beliefs and hedonic balance are unimportant for objectively measured academic achievement.

The finding that irrational beliefs for depreciation had a negative association with hedonic balance is in line with a body of research that has demonstrated an important connection between irrational beliefs and various affective outcomes (Bridges & Harnish, 2010; Visla et al., 2015). That depreciation emerged as the dimension most important for hedonic balance is an important new finding and indicates that not all irrational beliefs relate to affect, but rather, it is those specific to feelings of worthlessness that have an important connection. Importantly, the study also explored cross-time associations and found that increases in depreciation from mid-semester to end of the semester was associated with more

negative (relative to positive) affect. This is important because a culmination of higher depreciation (and associated negative affective state) at the end of the semester might reflect contextually driven mechanisms that can harm the well-being of students (see Turner, 2016).

Past research has shown that irrational beliefs are relatively stable over time (Turner & Moore, 2015), and therefore the finding that irrational beliefs for academic performance are susceptible to change, and that this change is associated with subsequent negative affect, is an important new development, and could point towards an increase in environmental stressors near the end of a semester. Indeed, the relationship between irrational beliefs and negative affect does appear stronger in the presence of stress (Visla et al., 2016). Another important finding was that increases in irrational beliefs from mid-semester to the end of semester were associated with increases in negative affect (relative to positive affect). This cross-time association provides evidence of an important temporal connection between irrational beliefs and hedonic balance. Experimental methods can help to shed further light on a possible bidirectional causal relationship between irrational beliefs and hedonic balance, and is an important direction for further research.

A strength of this investigation is the inclusion of an objective measure of academic performance. Contrary to our hypothesis, we found that irrational beliefs for academic achievement were unrelated (in a linear or curvilinear manner) to end of semester grades. On reflection, this hypothesis was tentative at best as there is no strong evidence that irrational beliefs harm academic performance. Some authors (e.g., Turner, 2016) have suggested that irrational beliefs are similar to the introjected regulation concept in self-determination theory (Deci & Ryan, 1985) that is related to higher levels of anxiety and negative affect, but also increased levels of effort (Ryan & Connell, 1989). This might suggest that while irrational beliefs might be detrimental to psychological states (subjective well-being) they might also facilitate greater effort and motivation counteracting any potential decreases in performance

that would otherwise have resulted from negative affect. An alternative explanation is that positive and negative affect each combine discrete emotions that might have differing effects on performance outcomes. Indeed, in the current study hedonic balance was unrelated to academic performance. The binary model of distress (Ellis, 1994) considers that irrational beliefs can sometimes lead to “adaptive” negative affect (see David, Montgomery, Macavei, & Bovbjerg, 2005), and the motivational-dimensional model of affect (Gable & Harmon-Jones, 2010) considers that positive and negative emotions relate to performance differently depending on the level of approach or avoidance motivation inherent in the emotion. Indeed, past research has found that positive emotions can sometimes be maladaptive and negative emotions can sometimes be adaptive to outcomes (Allen, Jones, McCarthy, Sheehan-Mansfield, & Sheffield, 2013; Kashdan & Biswas-Deiner, 2014). At a basic level, our data suggests that an increase in negative affect (relative to positive affect) towards the end of the semester does not necessarily mean that students will underperform.

The study does have some potential shortcomings that readers should consider when interpreting main findings. First, the use of objective academic performance scores eliminates problems associated with self-report (such as social desirability bias), but there are some validity and reliability issues inherent in objective academic performance grades (see Kuncel, Credé, & Thomas, 2005). For example, environmental factors such as student illness might lead to poor academic grades, but a student might consider that they had performed very well given the circumstances. These individual difference factors are unaccounted for in objective academic performance measures. Second, there was a 16% attrition from the initial sample recruited and attrition analyses showed that dropouts tended to report more negative affect. This attrition might have attenuated some associations and findings should be considered a reflection of returning participants that might not necessarily be representative of all Australian undergraduate students. Last, the assessment of irrational beliefs and

hedonic balance over two time points provides evidence of cross-time associations, but the study did not manipulate independent variables meaning causality cannot be determined from the data set. Experimental methods are required to determine whether replacing irrational beliefs about academic performance with rational beliefs about academic performance leads to more positive affect throughout tertiary education.

To conclude, this study provides evidence of concurrent and cross-time associations between irrational beliefs (related to depreciation) and hedonic balance in undergraduate students in the early phase of tertiary education. The study also provides evidence that irrational beliefs and hedonic balance (and change in these factors over time) are unrelated to objectively measured academic performance grades. The findings of this study, should they be replicated in subsequent independent research, might be of value to clinicians interested in improving the academic experience. Assessments of irrational beliefs might be used as a method to identify students at risk of negative affect that would benefit most from inclusion in an REBT intervention, and that manipulating irrational beliefs (and facilitating positive affect) should have no potential adverse effects on academic performance. We recommend further studies explore factors that might moderate the connection between affect and academic performance (e.g., approach and avoidance motivation) and explore associations over the full (three to four years) of tertiary education.

### References

- Allen, M. S., Jones, M. V., McCarthy, P. J., Sheehan-Mansfield, S., & Sheffield, D. (2013). Emotions correlate with perceived mental effort and concentration disruption in adult sport performers. *European Journal of Sport Science, 13*(6), 697-706.
- Allen, M. S., Magee, C. A., & Vella, S. A. (2016). Personality, hedonic balance, and the quality and quantity of sleep in adulthood. *Psychology and Health, 31*(9), 1091-1107.
- Bridges, K. R., & Harnish, R. J. (2010). Role of irrational beliefs in depression and anxiety: A review. *Health, 2*(8), 862-877.
- Callaghan, C. W., & Papageorgiou, E. (2014). The use of human resources literature regarding the relationship between affect and student academic performance. *South African Journal of Human Resource Management, 12*(1), 1-11.
- Chapell, M. S., Blanding, Z. B., Silverstein, M. E., Takahashi, M., Newman, B., Gubi, A., & McCann, N. (2005). Test anxiety and academic performance in undergraduate and graduate students. *Journal of Educational Psychology, 97*(2), 268-274.
- Crawford, J. R., & Henry, J. D. (2004). The positive and negative affect schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology, 43*(3), 245-265.
- Cunningham, R., & Turner, M. J. (2016). Using rational emotive behavior therapy (REBT) with mixed martial arts (MMA) athletes to reduce irrational beliefs and increase unconditional self-acceptance. *Journal of Rational-Emotive & Cognitive-Behavior Therapy, 34*(4), 289-309.
- David, D., Montgomery, G. H., Macavei, B., & Bovbjerg, D. H. (2005). An empirical investigation of Albert Ellis's binary model of distress. *Journal of Clinical Psychology, 61*(4), 499-516.



- David, D., Schnur, J., & Belloiu, A. (2002). Another search for the “hot” cognitions: Appraisal, irrational beliefs, attributions, and their relation to emotion. *Journal of Rational-Emotive and Cognitive-Behavior Therapy*, 20(2), 93-131.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum.
- DiLorenzo, T. A., David, D., & Montgomery, G. H. (2007). The interrelations between irrational cognitive processes and distress in stressful academic settings. *Personality and Individual Differences*, 42(4), 765-776.
- Dryden, W., & Branch, R. (2008). *The fundamentals of rational-emotive behavior therapy*. West Sussex, UK: Wiley.
- Ellis, A. (1957). Rational psychotherapy and individual psychology. *Journal of Individual Psychology*, 13, 38-44.
- Ellis, A. (1994). *Reason and emotion in psychotherapy*. Secaucus, NJ: Birscej Lane.
- Ellis, A., & Dryden, W. (1997). *The practice of rational-emotive behavior therapy*. New York, NY: Springer.
- Gable, P., & Harmon-Jones, E. (2010). The motivational dimensional model of affect: Implications for breadth of attention, memory, and cognitive categorisation. *Cognition and Emotion*, 24(2), 322-337.
- Gonzalez, J., Nelson, J., Gutkin, T., Saunders, A., Galloway, A., & Shwery, C. (2004). Rational emotive therapy with children and adolescents: a meta-analysis. *Journal of Emotional and Behavioral Disorders*, 12(4), 222-235.
- Kashdan, T., & Biswas-Diener, R. (2014). *The power of negative emotion: How anger, guilt, and self doubt are essential to success and fulfillment*. London, UK: Oneworld.

- Kuncel, N. R., Credé, M., & Thomas, L. L. (2005). The validity of self-reported grade point averages, class ranks, and test scores: A meta-analysis and review of the literature. *Review of Educational Research, 75*(1), 63-82.
- Malouff, J. M., Schutte, N. S., & McClelland, T. (1992). Examination of the relationship between irrational beliefs and state anxiety. *Personality and Individual Differences, 13*, 451-456.
- Organisation for Economic Cooperation and Development (2016). *Education at a glance 2016: OECD Indicators*. Paris, France: OECD Publishing.
- Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of quantitative and qualitative research. *Educational Psychologist, 37*(1), 91-106.
- Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*, 746-761.
- Schimmack, U., Radhakrishnan, P., Oishi, S., Dzokoto, V., & Ahadi, S. (2002). Culture, personality, and subjective well-being: Integrating process models of life satisfaction. *Journal of Personality and Social Psychology, 82*, 582-593.
- Turner, M. J. (2016). Rational emotive behavior therapy (REBT), irrational and rational beliefs, and the mental health of athletes. *Frontiers in Psychology, 7*, 1423.
- Turner, M. J., Allen, M. S., Slater, M. J., Barker, J. B., Woodcock, C., Harwood, C. G., & McFayden, K. (2017). The development and initial validation of the irrational performance beliefs inventory (iPBI). *European Journal of Psychological Assessment*. Ahead of print issue.
- Turner, M. J., & Barker, J. B. (2014). Using rational emotive behavior therapy with athletes. *The Sport Psychologist, 28*(1), 75-90.

- Turner, M. J., & Moore, M. (2015). Irrational beliefs predict increased emotional and physical exhaustion in Gaelic football athletes. *International Journal of Sport Psychology, 47*(2), 187-199.
- Visla, A., Fluckiger, C., Grosse Holtforth, M., & David, D. (2015). Irrational beliefs and psychological distress: A meta-analysis. *Psychotherapy and Psychosomatics, 85*, 8-15.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063-1070.

Table 1

*Means, standard deviations, bivariate correlations for study variables at Time 1 and Time 2*

	<i>Mean</i>	<i>SD</i>	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
<i>Time 1</i>												
1. Primary irrational beliefs	25.37	3.71	.45***	.72***	.23***	-.09	.65***	.41***	.57***	.14	-.12	.03
2. Low-frustration tolerance	26.03	3.90		.46***	.35***	-.11	.28***	.63***	.31***	.27***	-.07	.11
3. Awfulising	23.23	4.17			.36***	-.10	.50***	.30***	.64***	.17*	-.07	-.07
4. Depreciation	17.63	5.60				-.48***	.14	.29***	.26***	.79***	-.45***	-.09
5. Hedonic balance	8.63	12.00					.01	-.14	.01	-.41***	.65***	.05
<i>Time 2</i>												
6. Primary irrational beliefs	24.95	3.77						.41***	.68***	.19*	-.06	.06
7. Low-frustration tolerance	25.77	4.07							.49***	.38***	-.22**	.09
8. Awfulising	23.66	4.21								.30***	-.18*	.03
9. Depreciation	16.64	6.20									-.51***	-.05
10. Hedonic balance	5.82	12.01										.00
<i>Time 3</i>												
11. Academic achievement	68.66	9.61										

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

Table 2

*Linear regression models for irrational beliefs on hedonic balance*

	1. Hedonic balance (Time 1)		2. Hedonic balance (Time 2)		3. Hedonic balance (Change)	
	<i>b</i> (s.e.)	$\beta$	<i>b</i> (s.e.)	$\beta$	<i>b</i> (s.e.)	$\beta$
<i>Step 1</i>	[ $\Delta F_{(2, 172)} = 2.95, p = .055, \Delta R^2 = .03$ ]		[ $\Delta F_{(2, 172)} = 5.23, p = .006, \Delta R^2 = .06$ ]		[ $\Delta F_{(3, 171)} = 43.93, p < .001, \Delta R^2 = .44$ ]	
Hedonic balance (Time 1)					.63 (.06)	.63***
Gender	4.54 (2.39)	.14	4.02 (2.36)	.13	1.18 (1.85)	.04
Age	.24 (.18)	.10	.46 (.18)	.19**	.31 (.14)	.13*
<i>Step 2</i>	[ $\Delta F_{(4, 168)} = 9.40, p < .001, \Delta R^2 = .22$ ]		[ $\Delta F_{(4, 168)} = 12.23, p < .001, \Delta R^2 = .21$ ]		[ $\Delta F_{(4, 167)} = 3.37, p = .011, \Delta R^2 = .04$ ]	
Primary irrational beliefs	-.22 (.32)	-.07	-.60 (.31)	-.19	-.49 (.27)	-.15
Low-frustration tolerance	.17 (.24)	.05	.33 (.24)	.11	.24 (.20)	.08
Awfulising	.32 (.29)	.11	.63 (.29)	.21	.46 (.25)	.16
Depreciation	-1.08 (.16)	-.50***	-1.07 (.16)	-.50***	-.50 (.15)	-.23**
<i>Step 3</i>			[ $\Delta F_{(4, 164)} = 4.19, p = .003, \Delta R^2 = .07$ ]		[ $\Delta F_{(4, 163)} = 6.23, p < .001, \Delta R^2 = .07$ ]	
$\Delta$ Primary irrational beliefs			.53 (.32)	.14	.50 (.26)	.13
$\Delta$ Low-frustration tolerance			-.31 (.28)	-.09	-.09 (.24)	-.02
$\Delta$ Awfulising			-.29 (.31)	-.09	-.72 (.26)	-.21**
$\Delta$ Depreciation			-.66 (.22)	-.21**	-.54 (.19)	-.17**

Note:  $\Delta$ , change score.

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$