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Test-retest reliability of the irrational performance beliefs inventory (iPBI).

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Abstract

The irrational performance beliefs inventory (iPBI) was developed to measure irrational beliefs within performance domains such as sport, academia, business, and the military. Past research indicates that the iPBI has good construct, concurrent, and predictive validity, but the test-retest reliability of the iPBI has not yet been examined. Therefore, in the present study the iPBI was administered to university sport and exercise students ($n = 160$) and academy soccer athletes ($n = 75$) at three time points. Time point two occurred seven days after time point one, and time point three occurred twenty-one days after time point two. In addition, social desirability was also measured. Repeated-measures MANCOVAs, intra-class coefficients, and Pearson ($r$) correlations demonstrate that the iPBI has good test-retest reliability, with iPBI scores remaining stable across the three time points. Pearson’s correlation coefficients revealed no relationships between the iPBI and social desirability, indicating that the iPBI is not highly susceptible to response bias. The results are discussed with reference to the continued usage and development of the iPBI, and future research recommendations relating to the investigation of irrational performance beliefs are proposed.

Keywords: REBT; irrational beliefs; reliability; performance; response bias
Test-retest reliability of the irrational performance beliefs inventory (iPBI).

Recent growth in the reported application of rational emotive behaviour therapy (REBT) in performance domains such as sport (Turner & Barker, 2014) and business (Turner & Barker, 2015) has highlighted the need for a performance-specific measure of irrational beliefs. Recent recommendations assert that new measures should consider situational perceptions in assessing psychological constructs (Ziegler & Horstmann, 2015) and therefore the irrational performance beliefs inventory (iPBI; Turner et al., 2016), the first measure of irrational beliefs within performance domains, was developed and validated. The iPBI was developed as a brief (28-item) psychometric for use in performance domains such as sport, academia, business, and the military. Guided by recommendations for the development of irrational beliefs measures (Terjesen, Salhany, & Sciutto, 2009), and building on extant psychometrics, the iPBI reflects current manifestations of REBT theory and measures only beliefs, not emotional and or behavioural outcomes.

Consistent with contemporary REBT theory (e.g., Dryden, 2015), the iPBI measures the four core irrational beliefs with 7-items measuring primary beliefs (PIB), low-frustration tolerance (LFT), awfulizing (AWF), and depreciation (DEP). This is important because dysfunctional emotions (e.g., immobilizing emotions such as anxiety) and associated maladaptive behaviours (e.g., withdrawal) stem from irrational beliefs (e.g., Browne, Dowd, & Freeman, 2010; Szentagotai & Jones, 2010). Therefore, the ability to accurately measure irrational beliefs can help to identify risk factors for dysfunctional emotions and maladaptive behaviours, and assess REBT effectiveness in clients. The goal of REBT is to reduce irrational beliefs in favour of rational beliefs, and therefore the iPBI needs to be sensitive to detect changes, while also being reliable enough to mark stability in irrational beliefs. In research examining the use of REBT in sport, the Shortened General Attitudes and Beliefs Scale (SGABS; Lindner, Kirkby, Wertheim, & Birch, 1999) has typically been used to
measure irrational beliefs. However, the SGABS is limited because limited because it does not represent current manifestations of REBT, and specifically, does not produce results for the four core irrational beliefs. In addition, the SGABS is not context-specific, and therefore the rationale for developing the iPBI was driven by the need to more accurately assess the four core irrational beliefs in performance domains such as sport, academia, business, and the military (Turner et al., 2016).

Initial development and validation data for the iPBI (Turner et al., 2016) indicates construct, concurrent and predictive validity, however this primary data did not indicate test-retest reliability. Some consider test-retest reliability to be the most important type of reliability when considering the use of a test as an outcome measure (Law, 2004). Test-retest reliability indicates the reproducibility of the measure, and its ability to provide consistent scores over time in a stable population (Aaronson et al., 2002). A valid and reliable measure of irrational beliefs should demonstrate that scores remain stable over time, unless REBT has been applied, in which case scores should significantly decrease post-intervention. This is important because much of the research applying REBT interventions in sport adopts single-case designs (e.g., Barker, McCarthy, Jones, & Moran, 2011), where outcomes are measured repeatedly throughout baseline and intervention period, thus psychometrics need to be reliable on repeated assessment.

Further, the performance domain sampled in the initial validation of the iPBI included only occupational workers, and did not include academic and or athletic participants (Turner et al., 2016). It is important to progressively validate the iPBI in all of the intended performance domains to ensure that it is a reliable indicator of irrational performance beliefs across multiple performance domains. Two performance domains for which the iPBI was initially developed are academia and sport, and the authors were able to sample United Kingdom (U.K.) academy soccer athletes and U. K. university students for the current study.
Recent research has indicated that irrational beliefs positively predict increases in burnout in athletes over a season (Turner & Moore, 2016), and are positively related to negative affect, and negatively related to positive affect in university students (Allen, El-Cheikha, & Turner, 2017). As such, testing the reliability of the iPBI in athlete and student samples is important in order to ensure contextual sensitivity of the recently developed measure. Therefore in the current study the test-retest reliability of the iPBI is examined in separate sport (soccer athletes) and academic (university students) samples, two of the performance domains for which the iPBI was designed. To be clear, we examine the test-retest reliability of the iPBI in two separate performance domains, namely an academy soccer athlete sample, and an academic student sample. The two samples are treated separately in the analyses in the current paper, but for brevity we show findings for both samples in the reporting the results.

The chief aim of the present study is to examine the test-retest reliability of the iPBI across three time points within a single calendar month, advancing the test-retest irrational beliefs research, where two time points just days apart is a more typical protocol (e.g., Lindner et al., 1999). The secondary aim of the current study is to explore the social desirability of irrational beliefs. Social desirability is a key concern when considering the validity of scores produced via self-report psychometrics, which are inherently open to response bias (van de Mortel, 2008), and therefore affects the validity of a questionnaire (Huang, Liao, & Chang, 1998).

Method

Participants

Participants were university students enrolled on a sport and exercise science course \( (n = 160, \text{Mage} = 20.79; \text{SD} = 3.70; \text{first year of study} = 119 \text{ students}; \text{second year of study} = 41 \text{ students}; \text{female} = 33; \text{male} = 78; n = 49 \text{ participants did not indicate their sex}) \) and academy soccer athletes \( (n = 75; \text{Mage} = 15.92; \text{SD} = 1.74; \text{female} = 33; \text{male} = 42) \). Students
were recruited from the sport and exercise department at a university in the U.K. Data were collected using convenience sampling, whereby students were accessed through a university lecturer who distributed the questionnaires on three separate occasions to their sport and exercise students. In their studies, students had not learned about irrational beliefs, or REBT. Academy soccer athletes were recruited from a Premier League Category 1 U.K. mens soccer academy, and from a U.K. womens Tier 2 Premier League regional talent club. For soccer athlete data, the clubs’ sport psychologist distributed the questionnaires on three separate occasions. These samples were targeted because participants are required to perform on a regular basis, whether it is in exams and assessments (students), or competitive sport (soccer athletes), and the iPBI was developed to assess irrational beliefs within these performance domains. Ethical approval was granted by the university, and all participants completed informed and or minor (soccer athletes only) assent prior to any data collection. All data were collected using pen and paper questionnaires, within environments the participants were familiar with. That is, soccer athletes completed the questionnaires in a meeting room at the football club, while students completed the questionnaires in a lecture theatre.

Measures

Irrational performance beliefs. To assess the presence of irrational beliefs, participants completed the iPBI (Turner et al., 2016). The questionnaire is designed for usage in performance domains (such as sport or academia) and consists of 28-items, seven-items for each of its four subscales (PIB, LFT, AWF, and DEP). Scores from each subscale are summed to form a composite irrational performance beliefs score (COMP). Responses are made on a 5-point Likert-scale ranging from 1 (strongly disagree) to 5 (strongly agree). The iPBI has been shown to have good criterion, construct, and concurrent validity (Turner et al., 2016). For the current sample at first completion (N = 225), Cronbach’s \( \alpha \) were PIB = .63, LFT = .76, AWF = .76, DEP = .84, COMP = .87. Therefore, subscales demonstrated
acceptable to good internal consistency (Loewenthal, 2004). Further, data from all first completions showed that Mean subscale scores ($\text{MPIB} = 24.61, \text{SD} = 2.69$; $\text{MLFT} = 26.99, \text{SD} = 2.99$; $\text{MAWF} = 22.83, \text{SD} = 3.42$; $\text{MDEP} = 17.17, \text{SD} = 4.49$) were comparable to previous norms (Turner et al., 2016).

Social desirability. The brief social desirability scale (BSDS; Haghighat, 2007) was developed as a short social desirability scale for brevity and practicality, and has four questions. The BSDS was selected in the current study due to its usage in recent sport research (e.g., Kavussanua, Hatzigeorgiadisb, Elbec, & Ring, 2016). Participants were asked to respond to the four questions with a “yes” or a “no,” and a score of 1 was allocated to “yes” answers, and a score of 0 for “no” answers. Item four is reverse scored, because “no” is deemed to be the socially desirable answer. The BSDS is valid and reliable (Cronbach’s $\alpha = .60$) and free from gender specificity.

Procedures

Participants completed questionnaires at three time points. The development of similar measures (e.g., SGABS; Lindner et al., 1999) has deemed test-retest reliability across two time points sufficient to make recall of previous answers more difficult. Guidelines suggest that test-retest validity should be assessed at least several days following first completion (Law, 2004). The current study employed a more robust method by making the duration between time points longer, including a third time point to assess more long-term test-retest reliability, and by recruiting a larger sample. Specifically, 107 participants completed all three time points ($n_{\text{students}} = 52; n_{\text{athletes}} = 55$). This number of participants is in line with some previous test-retest research for irrational beliefs measures (e.g., Lindner et al., 1999; $n = 90$), and higher than recommended in guidelines, which advocates at least 30 participants (Law, 2004). In addition, for a medium effect size ($\eta^2 = .059$) to be detected using repeated measures analyses with sufficient power (.80), a sample size of $n = 30$ was
required for each of the two samples (Clark-Carter, 2010). At time point 1, after indicating consent, participants completed the iPBI, the BSDS, and provided demographic information. Seven days after time point 1, time point 2 occurred, where participants completed the iPBI only. Time point 3 occurred 21 days after time point 2, and participants completed the iPBI for the final time, and received a full debrief as to the aims of the study.

**Analytic Strategy**

Prior to main data analyses, data underwent missing values analyses and were screened for outliers. Missing data analyses showed that data were missing completely at random (MCAR) for AWF, $\chi^2 (6) = 7.24, p = .30$, and DEP, $\chi^2 (27) = 33.42, p = .18$, at time point 1 only. Therefore, the expectation maximization (EM) technique was conducted to replace missing values in these data. To identify outliers, Shapiro Wilks tests were performed, and $z$ scores inspected. Significant outliers with a $z$ score of 2SDs were windzorized (Smith, 2011).

For main data analyses, the two samples (students and soccer athletes) were treated separately. Main data analyses were conducted in three stages. First, two repeated-measures MANCOVAs (one test for students, one test for soccer athletes) were performed, with age as the covariate, to examine changes in each iPBI subscale (PIB, LFT, AWF, DEP, and COMP) across the three time points. Age was included as a covariate because past research indicates a negative linear association between irrational beliefs and age (e.g., Turner et al., 2016). It was important to analyze the soccer athlete and student samples separately in this instance in order to distinguish changes over time for each participant group. Second, intra-class coefficients (ICC) and Pearson’s correlation coefficients were calculated to examine the consistency of irrational beliefs scores across time points (e.g., Law, 2004).
Finally, two separate correlation analyses were performed for all first completions of the iPBI, one for the student data \((n = 160)\) and one for the soccer athlete data \((n = 75)\), to explore the relationships between irrational beliefs and social desirability.

**Results**

**Changes in irrational beliefs across the three time points.**

For soccer athlete data, the repeated measures MANCOVA revealed no effect for time, Wilk’s \(\lambda = .77, F (9,34) 1.15, p > .05, \eta^2 = .23\). For student data, repeated measures MANCOVA revealed no effect for time, Wilk’s \(\lambda = .91, F (9,35) .39, p > .05, \eta^2 = .09\).

Further, follow-up univariate analyses revealed no significant effects \((p > .05)\) for time in any of the variables across the soccer athlete or student samples (Table 1). The removal of age as a covariate did not change the direction or non-significance of results. Inspection of the means demonstrates a consistency in scores in all iPBI variables across time points 1, 2, and 3. ICC results (Table 1) and Pearson’s correlation co-efficients (Table 2) for soccer athlete and student data revealed strong agreement across time points for all irrational performance beliefs variables.

**Relationships between irrational beliefs and social desirability.**

Pearson’s correlation coefficients (Table 3) conducted for each of the samples revealed no significant associations between social desirability and the iPBI subscales.

**Discussion**

The current study had two main aims. First, the test-retest reliability of the iPBI was tested across three-time points in two separate samples that reflected the performance domains of academia (students) and sport (soccer athletes). Second, the relationship between iPBI scores and social desirability was examined, because social desirability can affect the validity of a questionnaire (Huang et al., 1998). Results indicate that the iPBI demonstrates good test-retest validity in both samples. Inferential statistics indicate that the four iPBI subscales, and
the composite scores, remained stable across the three time points in both soccer athlete and 
student samples. This is important because a reliable psychometric should provide consistent 
scores over time in a stable population (Aaronson et al., 2002). Further, iPBI scores were not 
related to social desirability scores. This study contributes significantly to the extant literature 
in several ways. First, this is the first study to examine the test-retest reliability of the iPBI. 
The finding that the iPBI is reliable on repeated administration across two separate samples 
and unrelated to social desirability, alongside past findings that the iPBI has construct, 
concurrent and predictive validity (Turner et al., 2016), establishes the iPBI as a sound 
measure of irrational performance beliefs. Second, to build on Turner et al’s (2016) initial 
iPBI research, which recruited an occupational sample, the current study included both 
student and soccer athlete samples. This is important because the iPBI was developed for use 
across different performance domains, and therefore should be tested within various 
performance samples including sport and academia. Further, the demonstration of test-retest 
reliability of the iPBI in two separate samples enhances in the findings.

The main finding of the current paper that the iPBI demonstrates good test-retest 
reliability has implications for the use of the iPBI and the investigation of irrational beliefs 
and REBT in performance domains. Support for the test-retest reliability, alongside past 
research evidencing construct, concurrent, and predictive validity (Turner et al., 2016), of the 
iPBI means that researchers and practitioners can be more confident in using the iPBI to 
measure irrational performance beliefs. That is, administrators of the iPBI can be more 
certain that the iPBI is a valid and reliable measure that not only measures what it proposes to 
measure, but can also be used as part of an ongoing, repeated-measures, assessment of 
irrational beliefs. This is particularly valuable in sport and exercise psychology where single-
case designs, with repeated markers of the dependent variables collected, are being used more 
prominently (e.g., Barker et al., 2011), thus requiring psychometrics that are reliable on
repeated assessment. Past research (e.g., Turner & Barker, 2013; 2015) shows that general
irrational beliefs (using the SGABS; Lindner et al., 1999) can decrease at the onset of REBT
in performance domains, and can return to baseline or remain stable depending on the
number of REBT sessions provided to participants. This research could be strengthened with
the use of a contextually valid measure of irrational performance beliefs such as the iPBI, and
therefore the further development and validation of the iPBI is paramount.

Addressing the limitations of the current study would further and more rigorously
assess the reliability of the iPBI. First, a broader range of athletes could be recruited across
various sports and age groups. Indeed, research that has examined REBT in sport has mainly
focused on football and cricket, but there is a need to broaden the athlete sample base to gain
a broader understanding of irrational beliefs, and the use of the iPBI in, for example,
individual and team sports. Also, in relation to recruiting student samples, future research
should address the large attrition in participants reported in the current study over the three
time points. The nature of collecting data from students in an academic domain means that
retaining all participants for repeated measures research is difficult. In the current study, we
decided that each time point happened at the same time in the day, which meant that if
students were absent that day at that time, we could not record their data. Future research
may consider using online survey tools to mitigate attrition, but researchers should be careful
to ensure data is collected at consistent times for each time point. Future research should also
collect data across multiple universities to broaden the student sample beyond a single
institution, as this may benefit the generalizability of the findings. Second, given that the
initial development and validation of the iPBI was conducted with an occupational sample, a
test-retest assessment should take place within that sample too. Since the iPBI was developed
for use across various performance domains, it is important to validate the measure across
those settings (e.g., sport, business, military, and academia). It should be recognized that the
current study includes soccer athlete and student populations only. Third, because the iPBI is a new measure, additional CFA analyses should be conducted across different samples. In the current, CFA could have revealed challenges to the four-factor structure of the iPBI, and researchers should recruit sufficient samples \( n > 200; \) Myers, Ahn, & Jin, 2011) in order to confirm the four-factor structure of the iPBI. Finally, to understand how the iPBI scores react to REBT, a repeated-measures intervention design should be conducted. The current study shows that iPBI scores remain stable in a non-intervention situation, but it is not yet fully known how the iPBI reacts to REBT (e.g., Deen, Turner, & Wong, 2017) and whether and to what extent reductions in irrational beliefs, as expected, would occur.

In sum, results from this study demonstrate test-retest reliability of the iPBI in separate soccer athlete and student samples. This is the first study to assess the test-retest reliability of the iPBI, and builds on past research showing that the iPBI has good construct, concurrent, and predictive validity (Turner et al., 2016). Social desirability scores were not related to iPBI scores, suggesting that the iPBI is not highly susceptible to response bias.

References


Table 1.

Repeated-measures Univariate ANCOVA, intra-class coefficients, Means ± SD for soccer athlete and student data across the three data collection timepoints.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Athlete Data</th>
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<th>Student Data</th>
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<td>Time 2 (7days)</td>
<td>Time 3 (30days)</td>
<td>ANCOVA</td>
<td>ICC</td>
<td>95% CI</td>
<td>ANCOVA</td>
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<td>PIB</td>
<td>24.39±2.87</td>
<td>23.78±2.73</td>
<td>23.25±2.55</td>
<td>F (2,84) = .49</td>
<td>.1</td>
<td>F (54,108) = 7.21*</td>
<td>.85</td>
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<td>LFT</td>
<td>26.82±3.17</td>
<td>25.88±3.46</td>
<td>25.78±3.99</td>
<td>F (2,84) = .15</td>
<td>.1</td>
<td>F (49,98) = 8.46*</td>
<td>.85</td>
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<td>AWF</td>
<td>22.33±3.61</td>
<td>22.22±3.30</td>
<td>21.53±3.05</td>
<td>F (2,84) = 2.35</td>
<td>.05</td>
<td>F (50,100) = 8.46*</td>
<td>.88</td>
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<td>DEP</td>
<td>16.75±3.52</td>
<td>17.00±3.22</td>
<td>17.75±3.42</td>
<td>F (2,84) = 2.50</td>
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<td>F (50,100) = 7.35*</td>
<td>.86</td>
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<td>COMP</td>
<td>22.47±2.70</td>
<td>21.99±2.64</td>
<td>22.05±2.28</td>
<td>F (2,84) = 1.70</td>
<td>.04</td>
<td>F (43,86) = 12.27*</td>
<td>.92</td>
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<td>PIB</td>
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<td>F (51,102) = 8.75*</td>
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<td>27.07±3.40</td>
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<td>26.02±4.41</td>
<td>F (2,98) = .60</td>
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<td>F (50,100) = 4.65*</td>
<td>.78</td>
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<td>AWF</td>
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<td>22.08±3.94</td>
<td>F (2,92) = .18</td>
<td>.01</td>
<td>F (47,94) = 7.17*</td>
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<td>DEP</td>
<td>17.11±5.36</td>
<td>16.62±5.45</td>
<td>17.79±4.68</td>
<td>F (2,100) = .13</td>
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<td>F (51,102) = 7.95*</td>
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<td>COMP</td>
<td>22.76±3.00</td>
<td>22.33±3.69</td>
<td>22.40±3.35</td>
<td>F (2,86) = .02</td>
<td>&lt;.01</td>
<td>F (44,88) = 9.78*</td>
<td>.90</td>
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Note. *p<.001
Table 2.

*Pearson’s correlation coefficients (r) for each iPBI subscale for soccer athlete and student data across the three timepoints (all p < .001).*

<table>
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<tr>
<th>Variables</th>
<th>PIB Time 1</th>
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Table 3.

Pearson’s correlation coefficients (r) for irrational performance beliefs, perceived helpfulness of beliefs and social desirability, for the first completion of all measures in the soccer athlete sample and the student sample.

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*Note. *p<.05, **p< .01