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Managing performance anxiety and improving mental skills in conservatoire students through performance psychology training: a pilot study

Margaret S Osborne[1*], Don J Greene[2] and Don T Immel[1]

* Correspondence:
mosborne@unimelb.edu.au
[1]Melbourne Conservatorium of Music, The University of Melbourne, Vic 3010, Australia
Full list of author information is available at the end of the article

Abstract

Background: Students with a strong sense of competence in musical skills and control over their physical and psychological well-being enhance their capacity to exceed their average level of performance and achieve an optimal or peak performance. Musicians transferring from the rehearsal studio to a concert performance demonstrate significant increases in heart rate and physical tension, which may or may not have a detrimental effect on their performance depending on whether they interpret those physiological symptoms as facilitating or debilitating to their performance. Negative, catastrophic interpretations feed debilitating performance anxiety, which is a significant occupational health issue for a high proportion of professional musicians as well as those training for a professional career in music performance.

Method: In early 2013, music students at the Melbourne Conservatorium of Music participated in two lectures and a master class in performance psychology techniques to achieve performance success, supplemented by a workbook of 11 strategies for audition and performance success for musicians. Topics included channeling performance energy, developing confidence, improving self-talk, learning and memorizing music, mental rehearsal, building courage, recovering from mistakes, dealing with adversity, and becoming mentally tough.

Results: Pre-post analyses on data from 31 students demonstrates that students can significantly reduce self-reported music performance anxiety, and significantly improve performance preparation, confidence, courage, focus, concentration, and performance resilience as a result of implementing these techniques.

Conclusion: This pilot study is the first empirical evaluation of a performance psychology skills training package developed from elite occupational and sports performance domains, and translated into the musician's training and performance preparation process. The pedagogical implications of the results support the inclusion of performance psychology skills training in undergraduate music performance programs, which may support the wellbeing of emerging performing artists into their future careers.

Keywords: Music performance anxiety; Intervention; Tertiary students; Performance arousal; Mental skills training; Performance psychology; Optimal performance

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Background

Music making promotes mental health and wellbeing (Rickard and McFerran 2012), yet the significant distress experienced when performing music causes many people to avoid it (Osborne in press). An optimal artistic performance is the result of a complex interaction of personal characteristics, task characteristics, and performance setting (Kenny 2011). The educational and professional requirements for performance excellence under pressure places significant demands on performers' physical and mental health (Ackermann et al. 2012). In order to perform in the upper range of their capabilities, a musician requires three factors working in tandem: musical competence, optimal physical wellbeing, and optimal psychological wellbeing (Kenny 2011; Williamon 2004). The experience of chronic and excessive anxiety when executing a musical performance in educational and occupational settings serves as the primary threat to the psychological wellbeing of musicians (Kenny 2011; Osborne in press). It is the most common risk to the mental health of Australian professional musicians, particularly for females and younger musicians less than 30 years of age (Kenny et al. in press). The two most frequently cited reasons for music performance anxiety (MPA) in professionals are high self-expectations, and worries about the negative impact of excessive physical arousal prior to, or during the performance. This drives 31% of musicians to self-medicate on beta-blockers in order to cope with occupational demands (Kenny et al. in press). Up to 70% of musicians across 56 western orchestras report that anxiety negatively interferes with their performance (James 1998).

There is some evidence that conservatoire students report significantly higher performance anxiety than professionals in prestigious worldwide orchestras (Steptoe and Fidler 1987). MPA leads to marked distress and impaired musical performance for up to 21% of college level (tertiary) students (Wesner et al. 1990). This drives up to 37% of students to seek help with music-related stress (Dews and Williams 1989; Kaspersen and Goetestam 2002), which in the first instance are their instrumental teachers rather than appropriate medical practitioners (Williamon and Thompson 2006). Up to 15% use pharmacological or non-pharmacological anxiety management strategies (Tamborrino 2001). The six most cited causes of MPA in tertiary-level students include inadequate preparation, pressure from self, general lack of confidence in self, attempting repertoire that is too difficult, and excessive physical arousal prior to or during a performance (Kenny 2011).

Anxiety, stress and optimal performance

Anxiety is a normal and healthy reaction to perceived danger that triggers a variety of physical, mental and behavioral changes in order to facilitate a speedy response (WHO 2004). Similarly, MPA typically manifests as a constellation of three interactive yet partially independent factors: cognitions, autonomic arousal, and overt behavioral responses (Craske and Craig 1984; Lang 1993). Typical cognitions or worries experienced in response to being asked to perform include worry about not being able to perform perfectly, fears of making a mistake, fear of being negatively evaluated by others, overestimations of the likelihood and consequences of a negative evaluation of the music performance, and negative self-evaluation in relation to one's own high standards for performance quality (Kenny 2011; Kenny and Osborne 2006; Osborne and Franklin 2002). On detecting danger, the elevations in autonomic arousal and tension of the

sympathetic nervous system (which can occur during excitement *as well as* anxiety) occur in an almost reflexive urge to escape or stand and engage with the threat (Barlow 2002). This is characterized by physiological symptoms such as racing heart, dry mouth, rapid breathing, sweating, gastric disturbances and dizziness, which can affect the dexterity of fine motor skills required to execute an optimal performance (Williamon 2004; Yoshie et al. 2009).

Performing music is one of the most complex human performance tasks, incorporating complex cognitive (e.g., problem solving) and sensorimotor (i.e., execution and sequencing of controlled body movement) skills (Altenmüller and McPherson 2008). When performers are performing at their best (known as a peak performance), they report feeling highly confident, without fear of failure, are in control of their emotions, thoughts and physiological arousal, and highly energized yet physically and mentally relaxed. They are totally immersed in the activity and execute tasks effortlessly and automatically. Successful performers view anxiety as beneficial by reframing it as performance energy or excitement (Brooks 2014). Poor performance is associated with self-doubt, feeling over- or under-aroused, loss of concentration, and maintaining a focus on the outcome of the performance (Krane and Williams 2010). In high stress states, individuals have greater difficulty learning, remembering and executing skilled behavior (Kim and Diamond 2002). 'Choking under pressure' describes performance decrements under pressure conditions despite the individual striving to perform well (Beckmann et al. 2013). The performance-stress model of choking in Figure 1, drawing from the work of Nideffer and colleagues (Nideffer and Sagal 2001; Williams et al. 2010) demonstrates how these factors can work together to produce a sub-optimal music performance.

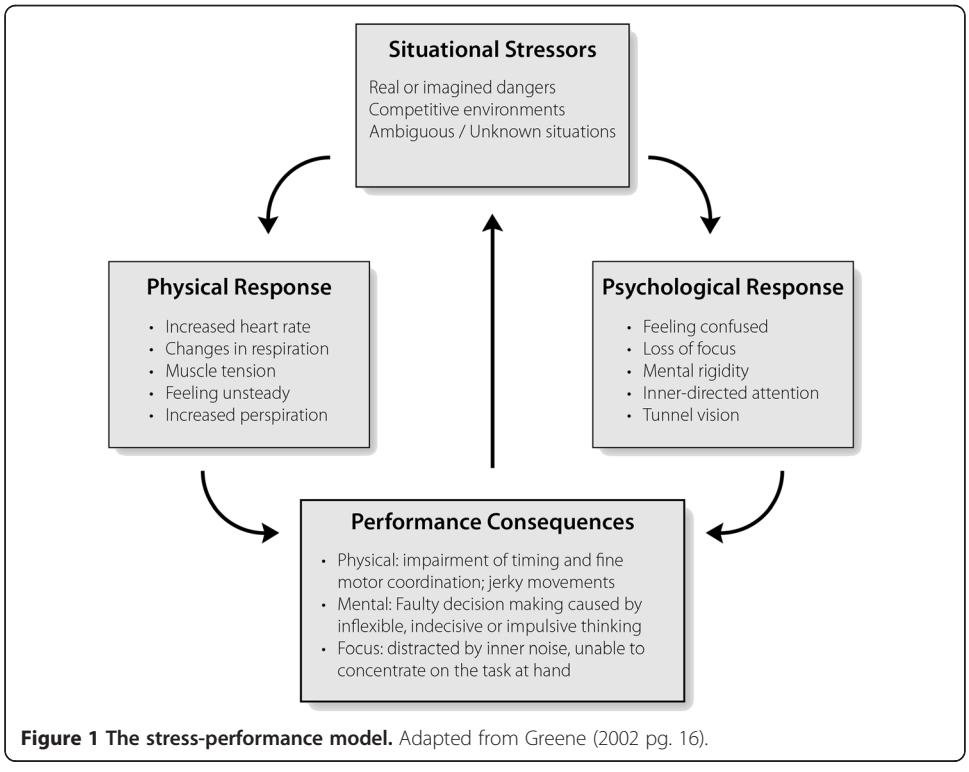

Figure 1 The stress-performance model. Adapted from Greene (2002 pg. 16).

In and of itself, anxiety is not a maladaptive state which needs to be removed in order to perform optimally. Musicians transferring from the rehearsal studio to a concert performance demonstrate significant increases in heart rate and physical tension, which may or may not have a detrimental effect on their performance depending on whether they interpret those physiological as facilitating or debilitating to the performance (Connolly and Williamon 2004; Hanin 2010). A moderate amount of anxiety enhances performance when an individual's skill level matches the performance demands of the situation (Jackson and Csikszentmihalyi 1999), and the individual interprets that anxiety positively (Jones et al. 1993; Papageorgi et al. 2013). The typical "fight or flight" response in high anxiety states tends to motivate success oriented students to "fight", that is, to approach a performance situation and undertake the necessary preparation required to achieve optimal performance outcomes (Martin and Marsh 2008). Success-oriented students tend to be optimistic, proactive and positively orientated to tasks, and respond to setbacks and failure with optimism and energy (Covington 1992). These are the psychological characteristics of performance resilience, the "individual's ability to deal effectively with performance setbacks, stress and pressure" (Martin 2008, pg. 29).

Interventions

Treatment methods for MPA include behavioral, cognitive, cognitive-behavioral, pharmacological, and alternative therapies (Kenny 2011). The most effective clinical anxiety treatment paradigm for MPA involves a combination of cognitive and behavioral techniques, including cognitive restructuring, attention control and behavioral rehearsal, relaxation and mental skills training (Clark and Agras 1991; Kenny 2011; Kendrick et al. 1982; Roland 1994). Cognitive restructuring techniques identify and challenge negative, self-defeating, task-irrelevant thought patterns and replaces them with more adaptive and realistic views. Relaxation strategies are aimed at counteracting the sudden and intense increase in physiological symptoms associated with the "fight or flight" response. Clinical anxiety interventions only partially address the need to perform optimally under pressure. Mental skills training protocols which draw from the discipline of sports psychology include techniques that integrate mind and body reactions under stress to enable a calm, focused, flexible and goal-oriented state of mind. The sports performance perspective is relevant because both athletic and musical performance require high levels of motor control and learning, mastery over mind and body, implicit recall and smooth performance, and performance in front of an audience which may invoke enjoyment of excellence, and/or psychological pressure (Yoshie et al. 2009).

Pre-performance routines have a significant bearing on the likelihood of choking under pressure in sport (Hanton et al. 2004). Consistency and reproducibility of a pre-shot routine is one of the most important differences that distinguish experts from novices in sports with a preparatory period, such as golf (Milton et al. 2007). Pre-performance routines which combine psychological and behavioral components decrease the likelihood of choking, compared to singular methods of deep breathing, cue word, temporal duration or no routine control (Mesagno and Mullane-Grant 2010). Pre-performance routines which increase right-hemisphere activation through hemispheric-specific priming attenuates motor skill failure under pressure conditions in gymnasts (Beckmann et al. 2013). Stronger left-hemispheric inhibition is associated with better performance in golf-putting and other automatic behaviors such as music performance. This

is because increased pressure engenders the desire to perform well, directing attention inward to conscious monitoring of the execution of motor behavior (see Figure 1). Attention to execution at the step-by-step level (left-hemisphere dominant) interferes with the execution of automatic processes (right-hemisphere dominant), causing the expert performer to regress to the level of novice in early, cognitive phases of motor learning (Gucciardi and Dimmock 2008). Given that the two dominant drivers of MPA in musicians of all backgrounds are negative, debilitating thoughts and excessive physiological arousal (Kenny 2011; Kenny et al. in press) which is characteristic of left-hemispheric over activation, research establishing the efficacy of similar pre-performance routines in music performance is therefore warranted.

In one of the few studies investigating the efficacy of sports psychology-based mental skills programs to enhance music performance resilience for conservatoire students, Clark and Williamon (2011) implemented a 9 week combined group (60 minutes/week) and individual (30 minutes/week) mental skills training program covering three broad areas: 1. motivation and effective practice; 2. relaxation and arousal control; and 3. performance preparation and enhancement. After participating in the program, the experimental group of 14 students (as compared to a control group of 9 students) self-reported significant improvements in self-regulated learning skills, quantity of practice and technical proficiency, self-efficacy for a prominent performance role (e.g., a soloist), and imagery vividness. Students commented that the program encouraged a more positive attitude toward performance anxiety and heightened control over anxious responding, greater self-awareness and confidence, and a healthier perspective towards music making overall. Performance quality could not be assessed due to poor correlation between two expert judges. Importantly, despite the substantial amount of material presented in the program, there was no change in cognitive or somatic anxiety, and self-confidence did not improve.

Psychological interventions which successfully enhance human performance include an assessment of the individual's skills prior to commencing the intervention (Hankes 2012). This is particularly important for musicians, given the broad range of triggers and symptoms of MPA (Kenny 2011; Papageorgi et al. 2013; Roland 1994). Greene's *Performance Success* program (Greene 2002, 2012a) integrates a psychological performance skills assessment, the Performance Skills Inventory (PSI; Greene 2013), with 11 strategies drawing from music, education and sport performance psychology literature which are directly mapped to seven essential skills to optimise performance success under pressure. The seven broad factors and subscales of the PSI, mapped with the 11 intervention strategies, are presented in Table 1.

The key foundation of Greene's program is the centering process. This is a self-regulating technique which can be used pre- and mid-performance to control overactive autonomic activity and refocus attention towards performance cues which assist the execution of the musical piece in high pressure performance situations. There are four main parts to this technique. First, identifying a clear intention of what is to be accomplished in the task, e.g., "I'm going to learn how to center", or "I'm going to nail the high D in the aria". Second, distribution of body weight around one's center of mass (approximately two inches below and behind the navel). This counteracts the natural tendency for tension and energy to rise with nervous energy, such that the body communicates a readiness to perform. Third, a breathing technique that is initially

Table 1 Performance Skills Inventory (PSI) factors and 11 performance success strategies

PSI skill factor		PSI sub-scales	Intervention strategies
1	*Energy Regulation*		
	Ability to manage performance anxiety	Optimal Energy	*Energy*
		Performance Energy	Centering: controlling performance energy
		Audition Energy	
		Energy Regulation	
2	*Preparation*		
	Ability to acquire and retain new information	Ability to Learn	*Preparation I* Developing better practice habits
		Practice Habits	*Preparation II* Improving learning: overview of five learning modes, mental rehearsal, prioritizing material and identifying obstacles
		Memorizing Music	*Preparation III* Memorizing music
		Overall Preparation	
3	*Confidence*		
	Self-belief	Self-Talk	*Confidence I* Improving self-talk, developing positive self-talk habits
		Expectancy	*Confidence II* Mental rehearsal
		Mental Rehearsal	
		Overall Confidence	
4	*Courage*		
	Willingness to confront fears and take risks	Confronting Fear	*Courage* Becoming a more courageous performer, overcoming fear of failure
		Building Courage	
		Confronting Failure	
		Overall Courage	
5	*Focus*		
	Focus on command, not attending to distractions	Getting Present	*Focus* Focusing past distractions
		Achieving Mental Quiet	
		Focusing Past Distractions	
6	*Concentration*		
	Quiet mind under pressure of performance	Accessing Alpha	*Concentration* Concentrating on demand, energy and concentration
		Building Stamina	
		Concentrating on Command	
		Overall Concentration	
7	*Resilience*		
	Ability to bounce back	Recovering from Mistakes	*Resilience I* Rebound faster from mistakes
	from adversity	Mental Toughness	*Resilience II* Becoming mentally tough, training for adversity
		Overall Tesilience	

focused on taking deep breaths into the abdomen rather than the chest. When breathing out, performers release tension in muscle groups common in anxiety (e.g., neck and shoulder tension), as well as key muscles required in playing their instrument. Fourth, using a working model of the left and right brain, performers are directed to shift attention away from the left brain hemisphere. Responsible for a verbally dominant

analysis and judgment of the performance task, this hemisphere is helpful in learning a piece or specific technique, but a major obstacle to achieving the mental quiet necessary for optimal performance when it is flooded with stress-induced negative thought patterns. Instead, performers are instructed to engage the right brain hemisphere where the performer feels, hears and pictures themselves performing well. It is ideal for optimal performance, and mandatory for peak performance. For performing artists, the critical process is developing the ability to deftly switch between left and right brain, according to various musical demands (Greene 2002).

Despite the use of Greene's techniques by countless musicians only one study has empirically tested the efficacy of a brief intervention using the centering technique as a method to improve attentional focus, manage anxiety and improve performance quality under stress. Kageyama (2007) implemented a comparative study of two intervention strategies for enhancing performance quality – one emphasizing the physiological effects of anxiety (arousal control group), and the other targeting both the physiological and attention components using the seven step centering process (attentional control training group). Results after two 1.5 hour training sessions for 21 undergraduate music performance majors were inconclusive. There was no statistically significant improvement in performance quality, task focus, and no relationship between anxiety and performance quality. The attentional control training group achieved the greatest reduction in pre-performance state anxiety scores from pre-test to post-test compared to no-treatment control and arousal control groups, but the reduction was not statistically significant.

Thus, there is some indication that performance psychology techniques delivered within a conservatoire setting improve music preparation skills and self-efficacy in executing a musical performance, and build positive emotions towards music making. Yet, there is no firm evidence for improvements in managing MPA. Performance anxiety can be a barrier to learning in conservatoire students (Creech et al. 2009) and is at the highest level in young professionals just starting their careers (Kenny et al. in press). This evidence signals the need to further investigate methods which can equip tertiary-level music students with the necessary psychological skills to manage MPA, improve performance confidence, resilience and psychological wellbeing during their music performance training.

Aims

The primary objective of this study was to test the efficacy and applicability of a short mental skills training program using Greene's *Performance Success* program as an adjunct to the regular conservatoire music curriculum to improve students' capacity to regulate MPA when reframed as performance energy. It was hypothesized that MPA, as measured by the Performance Energy subscale on the Performance Skills Inventory (Greene 2012a, 2013), would decrease significantly. Additionally, it was hypothesized that by implementing the relevant strategies associated with their two weakest areas on the PSI, students would demonstrate significant improvements in self-reported mental skills associated with resilience in music performance, namely: improved preparation skills; confidence; courage; focus; concentration; recovery from mistakes and mental toughness.

Method

Participants

31 classical music students at a conservatorium situated within a major Australian university volunteered for the study. The majority of students were female (n = 22, 71%) and enrolled in the first (45.5%) or second (40.9%) year of an undergraduate music degree. Two were in third year and one a Masters/postgraduate student. The average age was 19.86 years (SD = 1.77). The main instrument learned was brass (33.3%), followed by woodwind (29.6%), voice (25.9%), piano (7.4 =%), and string (3.7%).

Measures

Demographics Age, gender, main instrument learned, course and year level.

Performance Skills Inventory (PSI; Greene 2012a, 2013). The PSI is an 84 item self-report inventory providing an assessment of 21 psychological performance skills (see Table 1). It is based on Nideffer's Test of Attentional and Interpersonal Style (TAIS; Nideffer 1976), the Athletic Motivation Inventory (Tutko and Richards 1972), and the Competitive Styles Inventory (Ogilvie et al. 1997) which profile athletes' attentional, motivational and performance styles and assess the degree of fit to those required for successful performance in sporting events. Greene tailored these measures into the PSI, an assessment tool which addresses musicians' anxiety management, learning, and performance skills aligned with optimal music performance. Respondents are asked to reflect on their most recent past performances and answer how true each statement is on a 5-point Likert scale of "1 = Untrue for me" to "5 = Very true". Example items for each skill subscale (comprised of 4 items each; 'r' denotes reverse coding) are: Optimal Energy "I do my best when I'm relaxed" (r); Performance Energy "I get extremely nervous before certain performances"; Audition Energy "Auditions place overwhelming stress on me"; Energy Regulation "I wish I could manage my nerves better" (r); Ability to Learn "I'm a good learner"; Practice Habits "My practices are usually productive"; Memorising Music "I'm able to perform from memory without any problems"; Self-Talk "I talk to myself in a positive way"; Expectancy "Going into most performances, I expect to do well"; Mental Rehearsal "I clearly see and hear myself performing flawlessly"; Confronting Fear "I feel bold on stage"; Building Courage "I continuously take the risks necessary to get better"; Confronting Failure "I'm not afraid of failing"; Getting Present "I direct my full attention to what I'm working on"; Getting Mentally Quiet "I quiet my mind so I can fully hear the music"; Focusing Past Distractions "I can focus even in distracting circumstances"; Accessing Alpha "I start overanalyzing and thinking too much" (r); Building Stamina "I usually run out of energy before I get to the end" (r); Concentrating on Command "I can concentrate when I need to"; Recovering from Mistakes "I have trouble recovering from mistakes (r)"; Mental Toughness "I dread difficult performance situations" (r). The full scale demonstrates acceptable internal reliability, Cronbach's α = .86.

Procedure

The study was approved by The University of Melbourne Human Research Ethics Committee. All students enrolled in music performance at the conservatorium were

invited to participate in the peak performance training program by email within the first month of the academic year. This email, containing the plain language statement and consent form, explained that the aim of the study was to improve our understanding of peak performance training for tertiary performing arts students in Australia. The second author was introduced as an internationally renowned expert in helping performers achieve peak performance, who would be delivering lectures before a residency at the university to conduct a week of master classes on essential skills for optimal performance. Students were instructed to complete the PSI online before the first lecture and immediately after the master class at a webpage connected to the second author's business website. The PSI was administered as part a larger survey administered to all performing arts students at the faculty to assess their overall performance health and wellbeing. This survey obtained basic demographic information, degree of musculoskeletal pain and injury and non-musculoskeletal problems and their perception of interference on practice/rehearsal/performance quality, and included a MPA inventory and motivation and engagement scale. Students could participate in the coaching program without being involved in the research study. Hard copies of the plain language statement and consent form were handed out and returned by 31 participants during the first lecture.

The peak performance training program was delivered over three weeks and consisted of two weekly lectures followed by a week of group master classes which were either focused toward a particular instrumental group (e.g., brass, voice), or open, in which students of any instrumental group could attend. Students could attend more than one master class. Students completed the PSI online before the first lecture and printed/downloaded their profile and the "11 Strategies for Audition and Performance Success" workbook and brought these with them to the first lecture. The first lecture of 90 minutes was co-delivered by all three authors. The first author provided an overview of performance anxiety, the negative impact on performers' health, the effect of stress on the body and the "fight or flight" response, the performance-stress model of choking, a summary of left and right brain hemisphere functions, and relationship of stress and anxiety to learning and executing motor behaviours under pressure. The third author then discussed his personal experience with debilitating MPA and coaching with the second author to achieve more consistent and optimal music performance under pressure situations.

The second author then presented via Skype from the US, projected on a large screen in the lecture theatre. Students were asked to write down their dreams, goals and aspirations for their performance career. Factors and sub-factors on the PSI profile were explained. The first of three centering coaching videos, the beginner level entitled "Performance Anxiety and Centering" (duration 17 min 34 sec; Greene 2012b) was shown which provided a rationale to the technique and described the seven steps, interspersed with personal vignettes from three professional musicians who demonstrated the technique. The steps of the centering process which take approximately 90 seconds, include:

1. Forming a clear intention of the performance goal;
2. Picking a focal point: a tangible focal point below eye level, softening focus on that point or closing eyes;

3. Concentrating on breathing: seven breaths in through nose, pause, and then out through the mouth, in order to become fully mindful of breathing;
4. Identifying key muscles on the inhale, and then releasing excess tension on the exhale, starting with the forehead, then the jaw, neck, and shoulders;
5. Finding one's center: 2-inches below the navel and 2-inches into the body, with a solid, balanced foundation from the waist down;
6. Switching from the left brain to the right brain by feeling, hearing and seeing one's self flawlessly executing the task;
7. Directing one's energy: imagining energy gathering momentum up from the center, and then firing it out through the eyes toward the focal point.

Three homework tasks were allocated: first, students were asked to practice the seven step centering technique included in the workbook several times a day over the coming week before the next lecture; second, to practice the strategy that corresponded to the lowest scoring subscale on the PSI (or second lowest if also centering); and third, to complete a daily centering log online with their name, date, their clear intention, strength of clear intention on 1–10 scale, additional strategy used, practice and performance goals, and an emotional rating scale. This blog was completed by less than 10% of the students and was therefore not analysed.

The second lecture lasted 60 minutes and was delivered by the second author using Skype projected to a large screen in a lecture theatre. The centering rationale and student homework practice was reviewed including an opportunity for questions and feedback. The second video "Intermediate Centering" was shown (duration 14 min 57 sec; Greene 2012b). In this stage, Steps 1 and 2 are omitted. The remaining five steps are done with fewer breaths and can be completed in 45 seconds. The homework tasks for the second week included repeated centering practice down to a five step process, plus the strategy relevant to the second lowest scoring subscale on their PSI profile.

The third session comprised of a one-hour master class commencing with the third video "Advanced Centering and Simulation Training" (15 min 01 sec; Greene 2012b). Advanced centering can be done in three breaths and takes less than 10 seconds. The aim of the first breath is to focus attention on breathing and dropping tension. The second breath allows the performer to be at their center. The third breath is for vividly hearing the first few bars of the piece to be played whilst simultaneously directing the flow of energy to the focus point. This session reinforced the rationale that it was necessary to habituate to the natural rise in anxiety leading up to a performance. Anxiety could be re-interpreted as positive energy to facilitate an optimal performance. Volunteering students were given the opportunity to role-play performances in front of the class in order to receive individualized feedback and simulate performance pressure situations.

Data analysis

This study employed a single group pre-post intervention design. The 21 subscales of the PSI served as outcome variables and were examined for normality. Pre-post distributions which both met Kolmogorov-Smirnov (K-S) criteria for normality ($p > .05$) were analyzed using the general linear model one-way repeated measures ANOVA test.

Subscales with one or both pre-post distributions significant at K-S $p < .05$ were analyzed using the related-samples Wilcoxon signed ranks test.

Results

Pre- and post-program descriptive statistics for subscales which met criteria for parametric analyses with their respective test values are given in Table 2. Descriptive data and test results for four subscales which did not meet parametric criteria are given in Table 3. Figure 2 presents significant results for the seven broad performance psychology skills.

Seventeen out of the 21 subscales showed significant differences pre- to post-program in the expected direction. The subscale measuring MPA, Performance Energy, significantly reduced, showing that participants reported feeling more relaxed when performing as a result of using the techniques. There were significant improvements in preparation skills including learning ability, practice habits and music memorization. Confidence significantly increased, through more supportive self-talk, optimistic expectations, and improved mental rehearsal. Students felt significantly more courageous in facing their fears and the possibility of performance failure. Ability to focus on music preparation and performance tasks in the present moment significantly improved, as students developed skills in quieting distracting thoughts and focusing past distractions. Students' reported significant improvements in concentrating on demand and performance stamina. Finally, resilience in the midst of a performance was significantly greater with participants reporting more immediate recovery from mistakes.

The four subscales which did not achieve statistical significance nevertheless demonstrated changes in mean values pre- to post-test in the expected direction of improved

Table 2 PSI subscale means (and standard deviations) pre- and post-program with repeated measures ANOVA results

PSI subscale	Pre			Post			*F*	*d*
	Mean (SD)	Min	Max	Mean (SD)	Min	Max		
Optimal energy	55.61 (13.02)	25	90	58.23 (14.98)	30	85	1.63	.24
Performance energy	66.16 (14.57)	40	95	61.29 (12.58)	35	85	4.32*	.52
Energy regulation	51.81 (21.85)	25	95	57.10 (19.99)	20	100	2.72	.36
Ability to learn	75.10 (12.11)	55	100	83.23 (12.88)	50	100	20.05***	.99
Memorizing music	53.10 (28.02)	20	100	60.00 (27.05)	20	100	6.54*	.70
Self-talk	55.58 (19.12)	30	95	64.36 (20.20)	30	90	8.05**	.78
Expectancy	63.74 (15.09)	40	90	73.23 (15.79)	45	100	11.23**	.90
Confronting fear	56.13 (20.24)	20	90	66.13 (16.47)	35	95	15.25***	.97
Building courage	58.65 (15.84)	30	90	68.23 (15.58)	35	100	16.63***	.98
Confronting failure	54.13 (17.46)	25	85	64.52 (21.27)	30	100	8.43**	.80
Getting mentally quiet	52.68 (14.86)	35	90	65.81 (15.39)	30	100	18.65***	.99
Focusing past distractions	63.58 (17.83)	30	95	74.52 (19.03)	25	100	9.03**	.83
Accessing alpha	59.07 (14.82)	35	90	65.32 (15.91)	30	95	5.35*	.61
Building stamina	71.32 (13.46)	35	95	78.71 (13.78)	40	100	9.91**	.86
Concentrating on command	71.65 (14.50)	45	100	81.29 (14.02)	40	100	17.95***	.98
Recovering from mistakes	57.42 (17.98)	20	95	65.16 (21.04)	25	100	4.38*	.53
Mental toughness	67.61 (14.57)	40	95	72.10 (15.10)	45	100	3.18	.41

Note: Degrees of freedom for all *F* tests are 1,30. *d* = observed power. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 3 PSI subscale means (and standard deviations) pre- and post-program with Wilcoxon signed-ranks significance

PSI subscale	Pre			Post			*Wilcoxon sig.*
	Mean (SD)	Min	Max	Mean (SD)	Min	Max	
Audition energy	73.65 (13.60)	50	98	71.29 (18.35)	35	100	.32
Practice habits	62.19 (15.81)	35	95	74.52 (16.60)	35	100	.000
Mental rehearsal	61.39 (16.88)	30	95	74.36 (15.21)	40	100	.001
Getting present	62.45 (15.73)	30	90	70.32 (13.90)	30	95	.006

performance skills. Although students felt slightly less nervous at auditions, their expectation of achieving optimal performance with elevated energy increased, associated with a strengthened ability to control the rush of nervous energy in high pressure situations.

Discussion

The results of this pilot study support the hypothesis that a performance psychology coaching intervention significantly reduces tertiary music students' performance anxiety. The centering technique was taught as the primary pre-performance routine. This was to gain control over the destructive escalation in nervous energy (i.e., physiological arousal) and distracted attention toward external (e.g., audience, performance environment) and internal (e.g., anxious rumination) non-performance cues that can occur before and during a performance. Up to two additional strategies from Greene's (2012) "11 Strategies for Audition and Performance Success" workbook were used as appropriate for the lowest scoring areas on each participant's PSI profile.

The benefits of the program across all the psychological performance skills were substantial. Students improved their regulation of performance energy to a level at which they judged themselves to perform best. They improved their ability to acquire and retain new information. Self-belief and confidence in achieving optimal performance increased. They became more willing to confront their fears in anxiety-provoking performance circumstances, and accepted the risk of failure in striving for success. Focus and present-moment awareness improved along with reduced distractibility to non-performance cues. Students were more able to quiet their mind, concentrate on command, and build the energy required for optimal concentration and execution of musical performance tasks. Finally, they were more able to recover from adversity by refocusing attention away from mistakes during a performance, combined with a stronger, more mentally tough attitude when facing challenging performance situations.

Interestingly, despite the centerpiece of the program being the centering technique, the weakest statistical result was found for the Energy Regulation factor. Participants did indeed improve their ability to regulate and gain control over energy in high-pressure situations, and significantly so in the case of MPA (as measured by the Performance Energy subscale), yet the overall improvement on this factor was not statistically significant. This echoes the study by Clark and Williamon (2011), who found no significant differences or changes in trait or state anxiety between the mental skills training group and control group (curriculum as normal) students, despite anxiety and arousal control being addressed specifically within the training program. They attribute this to the multidimensional construct of anxiety with intensity and directional components

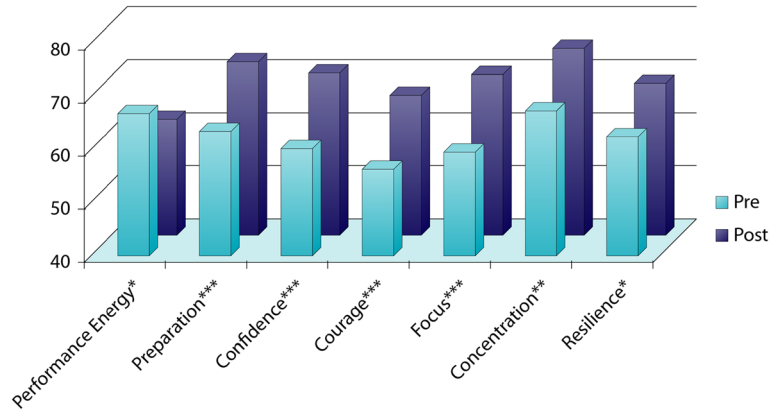

Figure 2 Pre- and post-program results for the seven PSI factors. Repeated measures ANOVA significance denoted as $p < .05$*, $p < .01$**, $p < .001$***.

(Jones et al. 1993; Miller and Chesky 2004), for which their study measured symptoms of intensity only. The current study addressed this issue through the PSI which measures anxiety as a multidimensional construct in both intensity (low, high) and direction (negative/debilitating, positive/facilitating). This moderate effect in Energy Regulation might be explained by the third session's emphasis on the potential of high performance energy to facilitate better performance, rather than as a negative aspect of performance which needs to be diminished in order to prevent a poor performance outcome.

Conclusions and directions for further research

This research provides preliminary yet powerful evidence for the benefit of performance psychology skills training in undergraduate music performance education to increase students' capacity to cope with escalations in debilitating MPA, and boost overall performance resilience. Positive outcomes may have been assisted by the thorough assessment of each students' performance psychology skills using the PSI, which maps directly to the strategies given in the workbook, providing targeted areas for improvement. The online methodology of the PSI and comprehensive workbook enables a very user-directed method for students to identify weaknesses *and* strengths, without placing too great an administrative burden on teaching or administrative staff. That said, the efforts to engage students in an extra-curricular research study within a heavily timetabled curriculum meant that the participation rate in this study was low.

Many strategies are covered within this coaching program and the research design did not enable an identification of the key strategies which led to the improvements. Insufficient practice diary data meant we were unable to determine to what extent participants followed instructions and practised the techniques corresponding to their two lowest profiles, or whether the effects were due to general exposure to the program. Delineating the precise mechanisms by which this takes place through practice diaries (or blogs), will facilitate our understanding of what strategies are being practised, how frequently and under what circumstances, in order to advance our knowledge of how and why these techniques are effective in improving the psychological wellbeing of

musicians. The conclusions of this study are also limited by the simple pre-post repeated measures design without a control group and long-term follow-up, and a single self-report inventory as an outcome measure. A subsequent study employing a waitlist control design with follow-up assessments has been conducted to tease apart potential improvements in anxiety management that result from program participation versus those that may occur through the standard music curriculum. This includes a theoretically-derived measure of MPA (the Kenny-Music Performance Anxiety Inventory; Kenny 2011) to facilitate meaningful comparisons across studies and to determine the construct validity of the PSI.

Performance quality was not assessed in this study, although it is a dominant concern for all musicians: will the investment of precious instrumental practice time to performance psychology strategies improve performance quality? The rigorous and highly demanding practice, rehearsal and performance schedule necessary to achieve sustained performance excellence in a music performance career is associated with decreased physical and emotional wellbeing (Ackerman et al. 2012; Kenny et al. in press). At this point there is insufficient data in the research literature to determine whether enhanced wellbeing leads to better performance. As a research outcome variable, performance quality is fraught with difficulty. Some studies support the relationship between decreased MPA and improved performance quality (e.g., Braden et al. in review; Hoffman and Hanrahan 2012; Roland 1994), and others do not (Deen 2000; Mansberger 1988; Osborne et al. 2007; Reitman 2001). An additional difficulty involves the disparity between judge's performance ratings which prevents their use as a single compound variable or renders them unusable due to bias (Braden et al. in review; Clark and Williamon 2011; Thompson and Williamon 2003). Conversely, this difficulty generates an important and reassuring psycho-educational message: that one's feeling of anxiety or distress in a performance may not necessarily be detected by the audience (Braden et al. in review). Therefore, from a music education perspective, students should be encouraged to consider that concerns of performance outcome and audience opinion may be less important than their mental and physical health over a lifetime of performances. This is an important issue given that assessment (from self- or audience), whether in the educational or entertainment context, is a complex and integral part of music performance (McPherson and Schubert 2004). Further work is needed in order to overcome these challenges in future studies which examine the efficacy of performance coaching interventions to enhance music performance.

This study provides important new insights into the psychological mechanisms by which music performance students can maximize their performance potential and achieve their personal best. Strategies for performance anxiety management and performance enhancement grafted from the sports field to the musicians' training process improved the essential skills for performing artists: channeling performance energy, preparation, confidence, courage, focusing past distractions, recovering from mistakes, and dealing with adversity. It demonstrates that musicians who learn performance psychology skills in a conservatoire setting are not only able to better regulate and manage performance anxiety, they also improve in a range of skills associated with psychological resilience and wellbeing in music performance. This has far-reaching implications for all musicians.

Competing interests
The second author has the capacity to benefit financially from the findings presented in the paper.

Authors' contributions
MSO designed the study, applied for ethics approval, coordinated online data collection, wrote and delivered psycho-educational material in the first seminar, assisted in recruitment, analysed and interpreted the data and wrote the paper. DJG coconceptualised the coaching program, provided the assessment and intervention materials, delivered the seminars and master classes and provided clarification on his intellectual material in the write up of the study. DTI co-conceptualised the coaching program, acquired funding, assisted in program administration and recruitment, and assisted in delivering material in the seminars and coaching sessions. All authors read and approved the final manuscript.

Authors' information
MSO completed a PhD at The University of Sydney investigating the phenomenology and treatment of music performance anxiety in adolescents. She is a consulting Registered Psychologist, occupational Rehabilitation Counsellor, Postdoctoral Research Fellow in music psychology at The University of Melbourne, and past President of the Australian Society for Performing Arts Healthcare. Margaret undertakes research evaluating the effectiveness of performance psychology programs to help musicians manage performance anxiety and enhance performance potential, as well as the empirical evaluation of factors that impact on engagement in music learning. As a result of her academic and professional practice, Margaret is passionate about integrating cognitive, behavioural and neuroscientific research to formulate best-practice methods to build mental and physical health and resilience, and maximise performance potential.
DJG completed his PhD in Psychology from U.S. International University in San Diego. His doctoral dissertation (1984) demonstrated that the sports psychology technique known as Centering significantly improved the performance and judgment of police SWAT officers involved in stress-shooting. Don was the sports psychologist for the US Olympic Diving Team and World Championship Swimming Team. He counselled professional golfers, tennis players, and Grand Prix drivers before turning his attention to performing artists. He was on the faculty of The Juilliard School, the New World Symphony Training Academy, and the New School Music Theatre program. Don currently serves as a consultant to the coaches, athletes, and sports scientists at U.S. Olympic Training Center in San Diego.
DTI is the Head of Orchestral Studies and Brass at the Melbourne Conservatorium of Music. He held a tenured Associate Professor position at the University of Washington (Seattle, 1999–2006) before moving to Denmark where he served as Solo/Principal Trombonist with the Sønderjyllands Symfoniorkester. He holds two undergraduate music degrees from Central Washington University, in performance and music education, and a Master of Music degree in trombone performance from Rice University in Texas. He has held posts as the principal trombonist with the Honolulu Symphony Orchestra and the principal trombonist for the South Jutland Symphony Orchestra in Denmark. In addition to his classical and academic activities, he has appeared onstage backing such performers as Renee Fleming, Elvis Costello, Bernadette Peters, and Linda Ronstadt, and played on numerous movie soundtracks. Throughout his career, DTI has organized and played with several jazz, rock and ska bands, as well as modern classical ensembles, and has released two albums.

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Author details
[1]Melbourne Conservatorium of Music, The University of Melbourne, Vic 3010, Australia. [2]Promind Sports, 4630 Catherine Avenue, San Diego, CA 92115, USA.

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