

Instructions to Adopt an External Focus Enhance Muscular Endurance

David C. Marchant, Matt Greig, Jonathan Bullough, and Daniel Hitchen

The influence of internal (movement focus) and external (outcome focus) attentional-focusing instructions on muscular endurance were investigated using three exercise protocols with experienced exercisers. Twenty-three participants completed a maximal repetition, assisted bench-press test on a Smith's machine. An external focus of attention resulted in significant ($p < .05$) improvements in performance compared to the internal focus of attention, but not the control condition. Seventeen participants completed repetitions to failure at 75% 1-RM on free bench-press and squat exercises. In both tasks, externally focused instructions resulted in significantly greater repetitions to failure than control and internal focus conditions ($p < .05$). These results support previous research showing beneficial effects of externally focused instructions on movement efficiency.

Key words: back squat, bench press, attentional focus

The optimization of the cognitive-training environment is a key aim of the psychologist working in the applied field of strength and conditioning. One critical factor is effective verbal instruction. Research has demonstrated that verbal instructions can influence a performer's or learner's attentional focus, which has subsequent influence on movement quality (e.g., Wulf, 2007). Verbal instructions emphasizing an outcome (or the effects) of a movement being executed (e.g., a goal, target, or intended effect) induce an external focus of attention, whereas instructions emphasizing the bodily movements associated with movement execution induce an internal focus of attention (e.g., specific movement of limbs during skill execution). Research has demonstrated that externally focused instructions are more beneficial to performers and learners than internally focused instructions in sport settings, for example, in golf (Bell, & Hardy, 2009; Wulf,

Lauterbach, & Toole, 1999), standing balance (McNevin, Shea, & Wulf, 2003), volleyball and soccer (Wulf, McConnell, Gärtner, & Schwarz, 2002), tennis (Wulf, McNevin, Fuchs, Ritter, & Toole, 2000), and dart throwing (e.g., Marchant, Clough, & Crawshaw, 2007). Furthermore, in rehabilitation settings, externally focused instruction has been shown to be beneficial to stroke patients in reaching movements (Fasoli, Trombly, Tickle-Degen, Verfaellie, 2002) and to assist Parkinson's patients' ability to maintain balance (Landers, Wulf, Wallmann, & Guadagnoli, 2005; Wulf, Landers, Lewthwaite, & Töllner, 2009). Benefits of externally focused instructions have been demonstrated in comparison to both internal instruction and control conditions (e.g., Landers et al.; McNevin & Wulf, 2002; Wulf & McNevin, 2003; Wulf, Weigelt, Poulter, & McNevin, 2003). Additionally, such research has shown that performance using internal instruction is similar to that in control conditions, indicating the potential risk that participants who do not get specific instruction direct their attention toward movement control, which impairs performance.

Highlighting associated mechanisms, the constrained action hypothesis states that attempts to consciously control movement (internal focus) interferes with automatic motor control processes and is attentionally demanding. This constraint on the motor system through conscious intervention reduces the effective coordination of move-

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David C. Marchant, Matt Greig, Jonathan Bullough, and Daniel Hitchen are with the Department of Sport and Physical Activity at Edge Hill University.

ments and muscular activity (e.g., Vance, Wulf, Töllner, McNevin, & Mercer, 2004; Zachry, Wulf, Mercer, & Bezodis, 2005). By focusing on the movement effects (external focus), motor control systems self-organize more naturally, leaving attentional resources free to process relevant environmental cues (see Wulf, 2007). Additional research further supports the automaticity associated with an external focus in terms of reduced probe reaction times (indicative of greater automaticity due to increased attentional resources; e.g., Abernethy, 1988) when performers adopt an external compared to an internal focus (Wulf, McNevin, & Shea, 2001). This position is in line with other theories of motor learning and performance, in which attention to skill execution is detrimental to performance and learning and should be avoided (e.g., Masters, 1992; Maxwell, Masters, & Eves, 2000; Singer, 1988).

Although Vance et al. (2004) advocated an external focus for maximal force production, few studies have applied this definition of attentional focus to force production or exercise tasks. Marchant, Greig, and Scott (2009) demonstrated that, during an isokinetic elbow flexion task, instructions emphasizing exerting maximal force against and focusing on the bar (external focus) resulted in significantly greater force production when compared to instructions emphasizing producing maximal force with and focusing on the movements of the arm (internal focus). Furthermore, an internal focus was associated with greater activation of the biceps when compared to an external focus. These findings supported previous research findings and the constrained action hypothesis through the increased muscular activity associated with the internal condition indicating greater “noise” in the motor system (Marchant, Greig, & Scott, 2008; Vance et al., 2004) and that this activity was associated with poorer performance (reduced basketball free-throw accuracy in Zachry et al., 2005). In a study using the vertical jump-and-reach test, Wulf and Dufek (2009) found that instructions that were externally focused (on the object being reached for) resulted in greater jump-and-reach height and center-of-mass displacement when compared to instructions with an internal focus (on the reaching movement). Furthermore, an internal focus was associated with limited force production through inefficient motor coordination of the lower extremity joints. These studies have suggested that the subtle qualities of verbal instruction significantly influence maximal force and power production. Specifically, attention should be directed towards the object or implement through which force is being exerted (e.g., weight lifted), or toward some intended target (e.g., reaching) if efficient movements are to be encouraged.

Research has yet to address whether such instructional differences influence muscular endurance in continuous force production tasks. Based on previous discussion of the effects of attentional focus on skill execution and force production, the efficient movement patterns and

muscular activity associated with an external focus may benefit prolonged exertion. Indeed, Wulf and Lewthwaite (2010) proposed that the findings to date suggest that an external focus should be associated with greater capacity to maintain submaximal force production. The inefficient movement patterns and muscular activation associated with an internal focus may limit potential muscular endurance capacity. The present study aims to investigate such predictions using common tests of muscular endurance.

Research using preparatory arousal and imagery (e.g., Caudill & Weinberg, 1983; Lee, 1990; Theodorakis, Weinberg, Natsis, Douma, & Kazakas, 2000; Weinberg, Jackson, & Seaboune, 1985) showed a beneficial impact of psych-up strategies on measures of muscular endurance (bench press, sit-ups, push-ups, pull-ups). Tod, Iredale, and Gill (2003) highlighted attentional focus as a key mechanism underlying the observed influence of preparatory strategies on improved muscular strength and endurance. However, few studies have adequately addressed the concept of attentional focus, in particular attentional direction, in their approaches to mental preparation.

This study used three common exercise protocols to investigate the effect of instructionally manipulated attentional focus on trained individuals' muscular endurance (repetitions to failure). The three exercises presented increasing degrees of complexity of muscular endurance tasks. The first exercise utilized the assisted bench press, where repetition movements are controlled using a Smith machine, which limits movements to the vertical plane. The second exercise presented a progression on this, utilizing the free-weight bench press. Here, bench presses are performed without restriction, using a barbell weighted with plates at both ends. The final exercise utilized the free back squat, in which participants performed squat movements with a weighted barbell held behind the neck, on the upper back and shoulders. Given the literature discussed, it is hypothesized that there will be a significant difference between the number of repetitions executed before failure on each task when using externally and internally focused instructions. Alternatively, instructionally manipulating attentional focus may not be effective with prolonged muscular exertion tasks due to the increasing salience of physiological feedback disrupting attentional focus (e.g., see Hutchinson & Tenenbaum, 2007). Internal and external verbal instructions were developed based on protocols used in previous research (e.g., Vance et al., 2004). Specifically, internal instructions directed attention to the limbs and movements associated with each movement, while externally focused instructions directed attention towards exerting force through the bar being moved. Within-subjects designs allowed control for interindividual variations in performance, with participants using external and internal focusing instructions in counterbalanced conditions to control for carry-over effects.

Method

Exercise Procedure

Maximal continuous repetitions to failure were performed on three exercises, at prescribed workloads. The research was conducted in a fully equipped strength-and-conditioning facility, providing naturalistic surroundings for these tasks. All participants were naive to the purpose of the study, were instructed to avoid caffeine and alcohol intake for at least 24 hr before testing, and were asked to arrive for testing appropriately hydrated and at a minimum of 3 hr postprandial. The Physical Activity Readiness Questionnaire (Thomas, Reading, & Shephard, 1992) and additional questioning gauged readiness for participation. The methodology for each experiment was approved at the institutional level, informed consent was obtained before participation, and participants were fully debriefed upon completion. Each participant's one repetition maximum (1-RM, the maximum weight an individual is able to lift in one repetition of an exercise, to determine appropriate exercise loads) was determined using standardized National Strength and Conditioning Association methods detailed by Harman and Garhammer (2008). Participants warmed up through both light cardiovascular exercise and by performing relevant exercise repetitions of submaximal load. Cadence was not controlled, but all participants were instructed to perform movements in a controlled manner. Failure was defined as an inability to complete a full movement repetition exclusively (bar movement ceases, or full extension not possible), or the failure to conduct such a movement in a safe manner with proper form (supervised by an experienced and qualified trainer).

The same exercise trainer acted as spotter throughout to ensure safety, using guidelines highlighted in Earle and Baechle (2008) for starting, monitoring, and completing exercises. The spotter provided no physical assistance, instruction, or verbal encouragement during the lifts. Some researchers suggest controlling for social facilitation in such tasks (e.g., Rhea, Landers, Alvar, & Arent, 2003). The current exercises could not be safely or accurately completed in isolation. However, to control for such effects, the same spotters and researcher were present for each task (for consistency), and no concurrent participation on the same (to avoid competitive effects) or different tasks (to avoid coactions effects) was used. The importance of individual performance was stressed, and participants were not informed of other participants' performance.

Instructional Procedure

Instructions for each exercise were developed in line with previous research on the manipulation of attentional focus (e.g., Vance et al., 2004; Wulf, 2007). Instructions were provided verbally and in writing before execution of

the task, and it was stressed that participants should follow the instructions throughout the task. The common aim of each exercise was to perform as many repetitions of the assigned weight as possible, while using the instructions provided. The same researcher gave instructions throughout all tasks; the trainer or spotters gave no instructions. To avoid the confounding use of previously instructed strategies, the control condition was completed first, followed by the counterbalanced internal and external instructional conditions. In the control (no instructions) condition, no additional instructions were provided to the participants and no specific attentional focus was emphasized ("Perform as many repetitions as you can before failure"). For the bench press exercise (Exercise 1 and Exercise 2), in addition to the common task instruction, internal instructions focused participants' attention on the arms ("Focus on moving and exerting force with your arms"), while external instructions focused on the barbell ("Focus on moving and exerting force through and against the barbell"). For the squat, safe positioning of the barbell behind the neck and across the shoulders was essential before completing the exercise. In addition to the common task instruction, internal instructions focused attention on the legs ("Focus on moving and exerting force with your legs"), while external instructions focused on the barbell ("Focus on moving and exerting force through and against the barbell").

No verbal encouragement was provided, but the researcher gave a specific brief instruction reminder when the trainer noted the participant was approaching failure (e.g., external: "Push the bar," internal: "Push your arms"). Approaching failure was defined as the point where deterioration in form and output indicated that only two more repetitions were likely. At such a point it was felt that attentional focus was likely to be disrupted, and efforts should be made to keep the participant focused in the desired way for as long as possible. For example, Hutchinson and Tenenbaum (2007) demonstrated that at high-intensity and prolonged-duration workloads, attentional focus shifts overwhelmingly to physiological signals. It is important to note that the instructions were not intended to influence their visual focal point. Rather, participants were instructed to perform the task to the best of their ability using the instructions they had been given, while looking straight ahead. After each trial, participants were asked whether they had followed the instructions.

Statistical Analysis

One-way repeated measures analyses of variance were used to assess differences in performance between each group (control, internal instruction, and external instruction). An overall measure of effect size is included (ω^2), and as a guide, .01, .06, and .14 represent small, medium and large effect sizes, respectively (Kirk, 1996). Post hoc

analysis was conducted through Bonferroni correction, with effect size r calculated and interpreted according to Cohen's (1992) guidelines: .10 was considered a small effect, .30 a moderate effect, and .50 a large effect. Paired t tests compared percentage changes (compared to control) in performance in internal and external conditions. Effect sizes, r , were calculated and interpreted as above.

Exercise 1—Assisted Bench Press

Method

Participants

The participants were 23 healthy regular exercisers (16 men and 7 women; M age = 30.87 years, SD = 12.27). All participants had at least 2 years experience with the exercise in question and were regularly using resistance exercise at least three times per week.

Procedure

Participants completed a modified version of the YMCA Bench Press Test, using guidelines from Harman and Garhammer (2008). They performed this protocol in a standard Smith machine, with the barbell attached at both ends to free running bearings on two vertical bars, allowing only vertical movement. Due to the availability of weight plate combinations, men lifted 40 kg and women lifted 20 kg (rather than the recommended 36 kg and 16 kg, respectively). In addition to a familiarization session, participants completed the task on three separate occasions: control condition, internal instruction condition, and external instruction condition. At least 3 days separated each session to allow adequate recovery.

Results

The results showed that the type of instruction provided significantly affected repetitions to failure on the Smith machine bench press exercise, $F(2, 44) = 12.44$, $p = .001$, $\omega^2 = .01$. An external focus of attention resulted in a significantly greater number of repetitions completed before failure ($M = 30.70$, $SE = 2.23$) when compared to an internal focus of attention ($M = 27.57$, $SE = 2.28$, $p = .001$, $r = .76$), but not compared to the control condition ($M = 29.13$, $SE = 2.27$, $p = .11$, $r = .43$). The latter two conditions were also not significantly different ($p = 0.05$, $r = .48$). When comparing performance to the control condition, this represents a significantly greater increase in performance ($M = 6.80\%$, $SE = 2.79$) for the external condition compared to a drop in performance for the internal condition ($M = -5.41\%$, $SE = 1.85$), $t(22) = 5.43$, $p = .001$, $r = .76$ (see Figure 1). The 95% confidence interval

for this effect was -16.57 to -7.54. All participants indicated they regularly used the instructions provided.

Exercise 2—Bench Press at 75% 1-RM

Method

Participants

Seventeen healthy and experienced resistance-trained male participants (M age = 20.82, $SD = 1.42$ years) were recruited from university undergraduate sports courses and a local fitness center. At the time of testing, all participants engaged in resistance exercise at least three times a week and had incorporated both the bench press and the squat exercises into their training for at least 1 year. Determination of 1-RM indicated a sample mean of 95.29 kg ($SD = 19.56$ kg, maximum = 140.00 kg, minimum = 65.00 kg). Before participation, and as part of familiarization, all participants were required to demonstrate correct bench press technique. The initial sample was 18 participants, but in posttask questioning one participant reported difficulty with the instructions due to an inability to stop using a personal strategy. This participant was removed from subsequent analysis.

Procedure

The participants reported to the testing setting on three separate occasions. Exercises were completed on a standard bench and rack. A weight set at 75% of one's 1-RM has been recognized to equate to 8–12 repetitions according to common program recommendations (e.g., Kraemer et al., 2002). The present and following exercise protocols aim to address the influence of attentional focus on endurance in this commonly prescribed repetition range. Starting positions were standardized, with participants positioning themselves with the bar at nipple height when in the lower position at the chest.

Results

Results showed that the type of instruction provided significantly affected repetitions to failure on the bench press at 75% 1-RM, $F(2, 32) = 37.04$, $p = .001$, $\omega^2 = .26$. An external focus of attention resulted in a significantly greater number of repetitions completed before failure ($M = 10.82$, $SE = 0.20$) when compared to an internal focus of attention ($M = 9.58 \pm 0.24$, $p = .001$, $r = .91$) and the control condition ($M = 9.53$, $SE = 0.30$, $p = .001$, $r = .92$), which were not significantly different ($p = 1.00$, $r = .07$). When comparing performance to the control condition, this represents a significantly greater increase in performance ($M = 14.22\%$, $SE = 1.84$) for the external condition when compared to the internal condition ($M = 1.17\%$, SE

= 2.36), $t(16) = 9.40$, $p = .001$, $r = .92$ (see Figure 2). The 95% confidence interval for this effect was 10.11–15.99.

Exercise 3—Free Squat at 75% 1-RM

Method

Participants

Participants in the free squat exercise were the same as those in the free bench-press (see Exercise 2). The same participant from Exercise 2 who indicated difficulty with using the instructions provided, also presented such concerns in this exercise and was removed from the analysis. Before participation, and as part of familiarization, all participants were required to demonstrate correct back squat technique. Standardized determination of 1-RM indicated a sample mean of 184.41 kg ($SD = 36.22$ kg, maximum = 250.00 kg, minimum = 110.00 kg).

Procedure

The standard free-weight back-squat protocol was used during this study, with the bar held in the high bar position (above the posterior deltoids at the base of the neck; see Earle & Baechle, 2008). Standard bar supports were used for effective and safe starting positions. Two spotters, including one certified instructor, were present to ensure safety while lifting free weights. The observing researcher was not one of the spotters.

Results

The results showed that the type of instruction provided significantly affected repetitions to failure on the squat exercise at 75% 1-RM, $F(2, 32) = 49.88$, $p = .001$, $\omega^2 = .32$. An external focus of attention resulted in a significantly greater number of repetitions completed before failure ($M = 11.06$, $SE = 0.18$) when compared to an internal focus of attention ($M = 10.06$, $SE = 0.18$, $p = .001$, $r = .98$) and a control condition ($M = 9.77$, $SE = 0.20$, $p = .001$, $r = .90$). The latter two conditions were not significantly different ($p = .29$, $r = .40$). When comparing performance to the control condition, this represents a significantly greater increase in performance ($M = 13.65\%$, $SE = 1.87$) for the external condition when compared to the internal condition ($M = 3.34\%$, $SE = 1.74$), $t(16) = 46.76$, $p = .001$, $r = .99$ (see Figure 3). The 95% confidence interval for this effect was 9.85–10.78.

General Discussion

The present study assessed the impact of attentional-focusing instructions on muscular endurance in three

progressively more complex exercises. In each exercise, muscular endurance was improved when externally focused instructions (e.g., focus on the movement of the bar) were provided, as compared to internally focused instructions (e.g., focus on the movement of the arms and legs), and in the two more complex exercises, improvements were also seen above the control condition (no additional instructions). Given that all participants were instructed to perform as many repetitions of each task as possible, the attentional focus induced through verbal instructions significantly affected their ability to do so. Therefore, the influence of attentional-focusing instruction is not limited to performance and learning, but also affects the ability to maintain repetitive forceful movements before failure.

In the assisted bench-press exercise, externally focused instructions resulted in a greater number of repetitions completed before failure when compared to internal, but not control, instruction conditions. Internally focused instructions resulted in the performance deteriorating compared to a control condition. As the movements in this task were restricted to the vertical plane (through the Smith machine), this potentially limited the impact of the attentional-focusing instructions. Recent research by Wulf, Töllner, and Shea (2007) demonstrated an interactional effect of task difficulty and attentional focus effects. During a balance task, easier conditions (solid surface) resulted in no beneficial effects of different attentional focuses. Conversely, when surface instability was increased, an external focus of attention benefited postural stability. When opportunity for error is large and there is more opportunity for conscious intervention, Wulf et al. concluded that an external focus provides performance benefits. Therefore, the subsequent exercises used here addressed complex weight-training movements. The findings for the free-weight bench-press (see Exercise 2) and back squat (see Exercise 3) exercises support previous research demonstrating external focus benefits compared to internal and control conditions, with the latter two conditions resulting in similar performance (e.g., Wulf et al., 2003). This indicates that providing externally referenced instructions improves performance over what would normally be achieved when only limited instructions are provided.

It is also interesting to note that as exercise complexity increased from assisted bench press, to free-weight bench press, and then to back squat, the associated effect sizes increased for the significant differences between changes in performance from control conditions ($r = .76$, $.92$, and $.99$ respectively) and total repetitions completed under each condition ($\omega^2 = .01$, $.26$, and $.32$ respectively). The progressive difficulty of each exercise is observed in potential for movement (the assisted bench press restricts movement to the vertical plane, whereas the free-weight exercises allow complete range of movement), in greater movement

coordination, and in musculature involvement in each movement. The major muscles involved in each exercise type is different, with three involved in the bench press (pectoralis major, anterior deltoids, and triceps brachii) and eight in the back squat (gluteus maximus, semimembranosus, semitendinosus, biceps femoris, vastus lateralis, vastus intermedius, vastus medialis, and rectus femoris; Earle & Baechle, 2008). Supporting the suggestions of Wulf et al. (2007), this observation suggests that, as movements become less restricted (e.g., opportunity for error increases) and more complex (e.g., greater muscular coordination required), the benefits of an external focus become more pronounced. Specifically, when promoting muscular endurance, focusing attention on the object being moved appears to become more effective when the movement is complex. However, future research is required to address this using weight-lifting movements (e.g., Olympic lifts such as the power clean, the clean and jerk, and the snatch), which are unrestricted and provide an opportunity to develop complexity in the movement.

Previous research demonstrating the influence of attentional focus on force production (e.g., Marchant, Greig, & Scott, 2009) demonstrates that the beneficial effects of an external focus are associated with increased movement efficiency and muscular recruitment (also see Wulf & Dufek, 2009). Conversely, an internal focus of attention has been associated with inefficient muscular activity (e.g., Marchant et al., 2008, 2009; Vance et al., 2004; Zachry et al., 2005) and movement patterns (Wulf & Dufek, 2009). Therefore, the constrained action hypothesis (Wulf et al., 2001) is relevant not only to maximal force production, but to muscular endurance tasks. It is likely that muscular endurance has been enhanced through more efficient movement patterns and muscular coordination, leading to greater repetitions. The ineffective cocontractions or “noise” in the motor system induced through an internal focus (e.g., Vance et al., 2004; Zachry et al., 2005) has resulted in decreased movement efficiency and fewer repetitions. Consequently externally focused instructions result in movements that are executed efficiently, with resultant forces generated with less muscular energy. Such energy efficiency in the present study results in a greater number of repetitions being executed. Focusing on the movement mechanisms results in unnecessary muscular energy expenditure, which limits the repetitive production of force. However, as with previous research (e.g., Wulf & Dufek, 2009), future investigation using kinematic analysis of lifting form is required for an accurate understanding of lifting mechanics associated with different attentional-focusing instructions. Finally, these findings could highlight some potential utility of an internal focus of attention. If the aim of the exercise is to produce maximum repetitions through efficient muscular coordination, then the focus of attention should be on the object toward which force is

being exerted (external focus). Conversely, faster muscular failure through largely inefficient muscular activation and coordination results from an internal focus on the movements being executed. Such an outcome may be of use in specific training or rehabilitation settings, but further research should address this.

Key limitations should be considered when interpreting these findings. Research needs to address the specific kinematics of lifts to failure under each attentional condition. For example, Duffey and Challis (2007) demonstrated changes in bench-press lifting kinematics of recreational exercisers during repetitions executed to failure at 75% 1-RM (e.g., changes in movement time, velocity, bar movement paths). Such data is required to highlight the mechanisms associated with each attentional condition's influence. Furthermore, early improvements in resistance training are suggested to be due to neuromotor adaptations to specific movements, rather than muscular characteristics, and therefore training correct movement patterns is important (Duffey & Challis). Research assessing lifting kinematics associated with different attentional focuses will also allow for the development of instructions that promote correct movement form. Finally, the instructional procedure adopted here included a novel approach, and this should be taken into account when interpreting the results. Instructional reminders, standardized across trials, aimed to encourage participants to use their specified attentional focus as they approached failure. Trainers and spotters will often encourage and instruct during these final movements. However, issues regarding the timing of these reminders and their specific influence on performance and attentional focus require future investigation.

Future research should also address how attentional focus manipulations influence the experience and perceptions of exertion during endurance tasks, which can affect volitional failure. Such perceptions are critical during single-joint muscle contractions, in which perceptions of exertion increase with contraction intensity and muscular fatigue (e.g., Pincivero & Gear, 2000; Williamson et al., 2002) and may be a mediating mechanism in the present findings. Such an approach would allow for a more in-depth assessment of instruction use and experience than the limited outcome-only approach used in the present study.

In conclusion, the findings of this study of three exercises indicate that the type of attentional focus induced through verbal instruction can significantly affect the number of repetitions completed in muscular endurance tasks. Given Ives and Shelley's (2003) indication that attentional focus plays an important role in effective strength training, this adds to the growing body of literature demonstrating the importance of instructional emphasis on movement execution and force production. Further research is needed to elaborate on the movement

kinematics of such effects. Furthermore, strength-and-conditioning research should detail and/or control the specific instructions provided to participants in testing protocols. Such clarity would allow for more accurate comparisons, given the effect that different instructional approaches can have on movement outcomes. Previous research showed that verbal instructions directing attention externally (on movement outcome) significantly benefit force production when compared to internally focused instructions (on movement mechanics; Marchant et al., 2009). The present findings extend this to show that externally focused instructions benefit muscular endurance tasks. Duffey and Challis (2007) suggested coaches should emphasize specific techniques (e.g., moving the bar over the shoulder during the lift phase and exploding, or lifting the bar rapidly during the early part of the lift phase to get through sticking points) due to the importance of neural changes early in a training program. The present findings suggest that to influence performance effectively, such emphasis should be external when verbal instruction is used. Instructions for the performance of muscular endurance tasks should direct attention to the outcome of the task or the movement of the apparatus. Failure to be aware of the effects that verbal instructions and attentional focus have on exercise execution could significantly decrease movement quality and limit the effectiveness of subsequent muscular and strength adaptations.

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Authors’ Note

Please address correspondence concerning this article to David C. Marchant, Edge Hill University, Department of Sport and Physical Activity, St. Helens Rd., Ormskirk, Lancashire, UK L39 4QP.

E-mail: David.Marchant@edgehill.ac.uk