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Identifying The Psyching-Up Strategies Used in Strength Sports: A Concept Mapping Approach

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ABSTRACT

It has frequently been reported that strength athletes use psyching-up strategies to enhance performance. Despite numerous investigations into the efficacy of these psyching-up strategies, there has yet to be a thorough exploration of the methods used by athletes to do so. Thus, it is important to explore the full breadth of strategies utilized by athletes. The present study aimed to identify the psyching-up strategies used by strength sport athletes and assess the perceived effectiveness on performance. Using a concept mapping approach, 246 strength sport athletes and coaches participated in an initial statement (technique) generation phase, and 112 sorted the techniques into clusters and rated the effectiveness of each technique at enhancing maximal strength performance. In the generation stage, 64 individual psyching-up techniques were identified. Similarity matrix generation, multidimensional scaling, and hierarchical cluster analysis were used to produce visual cluster maps, which identified eight separate clusters of psyching-up strategies: *"pre-performance routines"; "positive thoughts, feelings, images, and behaviors"; "goals and performance accomplishments"; "self-deprecation"; "negative thoughts, feelings, images, and behaviors"; "stimulation"; "physical and physiological techniques"; and "aggressive acts"*. Participants ranked *"pre-performance routines"* as being the most effective psyching-up strategy, with males reporting significantly higher ratings for *"self-deprecation"; "negative thoughts, feelings, images, and behaviors"; "stimulation"; and "aggressive acts".* The present findings demonstrated a greater breadth of psyching-up techniques than those currently examined within the literature. Accordingly, we suggest a revised definition of psyching-up strategies in the context of strength sports: "strategies intending to alter activation or to enhance mental preparedness, immediately prior or during skill execution".

INTRODUCTION

Competitive strength athletes commonly use psyching-up strategies to enhance performance in training and competitions (43). These are defined as "self-directed cognitive strategies that are used immediately before or during the execution of a skill to enhance performance" (10,42). Many athletes and coaches believe that psyching-up is pivotal in enhancing strength performance (38), yet limited research has examined the specific techniques that athletes employ. A recent systematic review (10) found that although psyching-up strategies could facilitate strength performance, only a relatively limited number of strategies have been examined. Without a thorough assessment of the methods used by athletes to psych-up, previous research may be limited by failing to utilize unexplored strategies. Accordingly, the present study used a concept mapping approach to identify and categorize the breadth of strategies utilized by strength coaches and athletes to psych-up, and the perceived effectiveness of these strategies.

Initial interest in the effects of psyching-up for strength performance originated from competitive strength athletes. Results from interviews with competitive weightlifters found that athletes employ psyching-up strategies during competitive events (24). Based on these reports, Shelton and Mahoney (38) undertook the first study that examined the efficacy of psyching-up strategies on maximal strength performance. Specifically, competitive Olympic weightlifters were asked to psych-up in their own way, prior to performing a hand dynamometer task. Grip strength performance was greater following use of a psyching-up strategy compared to a control condition. Follow-up interviews revealed that the participants implemented one of four strategies: self-talk, attentional focus, preparatory arousal, or imagery. Of these strategies, attentional focus was the most used within the cohort.

Previous research has predominantly focused on the four strategies identified in 1978 (38). To demonstrate this, a recent systematic review on psyching-up and strength performance (10) found that 82% of the studies primarily focused on self-talk, attentional focus, preparatory arousal, or imagery. In addition to these strategies, studies have also investigated the effects of relaxation (e.g., 33) and free-choice (e.g., 28). Although there is evidence that using psyching-up strategies can enhance strength performance, the findings have been inconsistent. For example, studies have reported positive (41,43), null (5,28), and even detrimental (12,32) effects of psyching up strategies on strength performance. Potential explanations for this lack of consistency include, but are not limited to: the skill level of the participants, the interventions used, and the rigidity of what constitutes a psyching-up strategy based on previous definitions (10). It was found that psyching-up strategies most consistently outperformed control conditions when an experienced participant had the autonomy to choose their own strategy (10). Specifically, free-choice psyching-up demonstrated the greatest level of consistency in significantly enhancing maximal force production compared to the other strategies. Additionally, 75% of the articles in the systematic review that utilized free-choice interventions sampled experienced participants. Despite the efficacy of free-choice strategies (e.g., 43,47,48), no article since Shelton and Mahoney (38) reported the strategies chosen by the participants in experiments. Additionally, limited attempts (35,50) have been made to examine the strategies used by athletes in training and competition.

The psyching-up strategies prescribed in some studies have been vague and lacking clear direction. For example, verbal instructions provided to inexperienced participants have included: "get emotionally charged up" (15); "get mad, get pumped up, get charged up" (12); and "get[ting] as mad and as charged up as you can" (49). Although interesting, these examples present three potential flaws within existing research. First, the instructions focus on the outcome rather than the process of achieving the desired state. Second, the participants in those studies had no reported experience in using psyching-up strategies, so it was not clear whether they had the required skills, knowledge, or experience to elicit the desired response. Third, various theories suggest that there is an optimal

level of arousal for performance (26,51) and that failing to meet or exceed this level of arousal can negatively impact performance. With the origins of psyching-up research deriving from its application within strength sports (24, 38), in addition to strength athletes still utilizing psyching-up with the belief it enhances performance (43), an examination of the strategies used by coaches and athletes can provide important insight into the techniques currently being used to optimize performance.

Consistent with the current definition of psyching-up (42), empirical studies have typically focused on self-directed interventions. This definition (42) has also been used as an inclusion criteria for literature reviews (10,42), excluding articles examining the effects of external stimuli, such as music (2), watching videos (33), and inhaling ammonia (3). Contrary to this, however, it has been reported that athletes engage in behaviors such as listening to music (50) and inhaling ammonia (35) during competition to psych-up. The exclusion of these strategies illustrates a potential disconnect between the scientific literature and the practice of psyching-up strategies in competitive environments.

The development of empirical research into psyching-up intended to test the effects of the strategies used by athletes (38). Yet, since the origin of this literature, there have been limited efforts to identify the psyching-up strategies that athletes use. Without first examining the strategies athletes use to psych-up, the efficacy of psyching-up cannot be fully understood. Therefore, using a concept mapping approach (46), the aim of the present study was to identify the psyching-up strategies used by athletes within strength sports, and to assess strength sport athletes' and coaches' perceptions of the impact that the strategies have on performance. Additionally, we aimed to investigate demographic differences in the perceived assessments of the strategies. Given the exploratory nature of concept mapping, no specific hypotheses were proposed for the study.

METHODS

Experimental Approach to the Problem

To investigate the psyching-up strategies used by strength athletes, a mixed-methods participatory concept mapping approach was used (46). Concept mapping is a structured method that organizes and represents ideas from a specific population on a topic of interest (45,46). Concept mapping has been demonstrated to have both good internal representation validity and sorting reliability (36), and has been used in a multitude of settings, including healthcare (17), education (27), and agricultural technology (31). In sport, concept mapping has been used to investigate barriers to implementing sports injury prevention programs (11), barriers faced by women within basketball (25), the educational needs of parenting youth athletes (14), and factors in the recovery from lower back pain in elite athletes (44).

The concept mapping process comprises six stages (46). First, the preparation stage involves the researcher identifying the focus and participants required for the concept mapping process. Second, the statement generation stage involves the participants providing statements representing the focus of the study (e.g., psyching-up strategies). Third, the structuring stage involves participants sorting and rating the statements from the preceding stage. Fourth, the representing stage involves analyzing the data and developing maps. Fifth, the interpretation stage involves interpreting the maps. Finally, the utilizing stage requires using the maps for future research and interventions.

Subjects

Concept mapping should aim to include a wide variety of relevant people (46). The inclusion criteria for this study were that the participants were at least 18 years old, and to have competed or coached a client to a minimum regional level competition within a strength sport. For the statement generation stage, we recruited 246 (Male = 143; Female= 103; Mean Age = 36.0 SD = 11.1) participants, comprised of 2 coaches, 201 athletes, and 43 identifying as both. The sports of the participants were strong(wo)man (n = 105), powerlifting (n = 117), Olympic weightlifting (n = 19), and "other" (n = 5). The highest competitive level of participants was regional (n = 53), national (n = 92), and international (n = 101) level.

For the sorting and rating stage, we recruited 112 (Male = 75**;** Female= 37 Mean Age = 33.5 *SD* **=** 8.7) participants, comprised of 1 coach, 89 athletes, and 22 identifying as both. Participants were strong(wo)men (n = 68), powerlifters (n = 39), and Olympic weightlifters (n = 5). The highest competitive level of this sample was regional (n = 23), national (n = 48), and international (n = 41) level competitors/coaches.

<u>Procedures</u>

Before data were collected, ethical approval was granted by an institutional review committee (ETH2223-2315). Purposive sampling was used with participants recruited through advertisement on social media pages related to strength sports. Additionally, the lead author utilized their network within strength sports to email various coaches and athletes. The recruitment materials provided brief information about the study and a link to an online survey (Qualtrics, Provo, UT, USA). An online survey was used to ensure a greater reach of participants across geographical locations, to enable them to share their psyching-up techniques anonymously, and include participants who may refrain from in-person data collection (4). The survey initially presented the information about the study, before obtaining consent to participate. The information sheet included details of an incentive offered to boost recruitment (i.e., participants who completed both phases of the study could choose to be entered into a raffle to win a six-month membership to the MST Systems mobile application). Participants then provided the following demographic information: sex, age, their predominant sport, their role in the sport (coach/athlete/both), and the highest level of competition they had reached as a coach or an athlete. The statement generation process then commenced where the participants were initially presented with a definition of psyching-up: "self-directed cognitive strategies that are used immediately before or during the execution of a skill to enhance performance" (42). Participants were then asked to list as many psyching-up techniques as possible. Following this, participants were given details of a second stage of data collection, and asked to

provide an email address should they wish to participate in that stage. Data were gathered for phase one over a period of 10 days during October 2023.

After the first phase of data collection was complete, the statements (psyching-up techniques) were analyzed by the lead researcher. Specifically, Kane and Trochim (21) recommended that if the statement generation process receives more than 100 statements, researchers should conduct a preliminary sort/synthesis. The synthesis involved analyzing the reported techniques, to first ensure that they represented a singular psyching-up process. Additionally, each technique was reviewed by the lead author to ensure it was relevant to the body of research, with any duplicate, irrelevant or unclear data being removed.

Following the synthesis of the psyching-up techniques, emails were sent to all those who initially consented to be contacted for phase two of data collection: the structuring stage. Further, we also sought to recruit participants who did not engage in the first phase through advertising on social media and directly contacting coaches and athletes. Participants completed an online survey (Qualtrics, Provo, UT, USA), which initially provided information about this stage of the research before obtaining consent for participation and gathering demographic information. Participants were then presented with the list of psyching-up techniques that were generated during the statement generation stage. Each participant was asked to sort the techniques into groups. The instructions for this grouping process were to sort the techniques based on what techniques they believed would be used together or produce the same outcome. If participants were not able to put any techniques into a meaningful group, they were asked to place all of these into a miscellaneous group. After grouping the techniques, participants were asked to name each group. Finally, participants were asked to rate how effective they perceived each individual technique to be at enhancing maximal strength, on a 5-point Likert scale ranging from 0 (not at all effective) to 4 (extremely effective). Data were gathered for phase two over a period of 20 days during December 2023 and January 2024.

Statistical Analyses

Consistent with previous concept mapping research (21,36), we used three analyses on the data generated in phase two: similarity matrix generation, multidimensional scaling analysis, and hierarchical cluster analysis, to create the maps. Initially, the data were exported into Microsoft Excel. A sift removed the miscellaneous groups from the data set for each participant, and then a binary square similarity matrix was created for each technique. Within a matrix, if a participant had grouped two techniques together a 1 was added, and if the techniques were not grouped together a 0 was added. The 64 separate matrices were then compiled to create the final binary square similarity matrix. A greater number of technique combinations indicated a greater number of participants compiling the techniques together.

The overall binary matrix was subsequently exported into SPSS V.28. To visualize the similarities between the techniques, a multidimensional scaling analysis was then implemented locating the techniques onto an x-y spatial "point map". A hierarchical cluster analysis was conducted using Ward's algorithm on the dimensions created from the multidimensional scaling. Through the multidimensional scaling, a branching diagram (dendrogram) was generated, providing a visual representation of the similarities amongst the techniques. This then allowed for the techniques to be partitioned into clusters, with clusters representing different groups of techniques that had the greatest similarity scores.

To evaluate the perceived effectiveness of the grouped strategies the mean scores from the Likert scales were calculated. First, the mean scores for each individual technique were calculated. Following this, the mean score for each clustered group was calculated. To investigate if there were any demographic differences in perceived effectiveness, we conducted three one-way MANOVA's, with the level of significance set to 0.05, to investigate differences in perceived effectiveness for each cluster. To understand the practical significance of the findings, Cohens' d effect size (7) was

also calculated for each MANOVA. Using the standardized classifications (7), an effect size of $d = 0.2$ is classified as small, $d = 0.5$ as medium and $d \geq 0.8$ as a large effect.

RESULTS

Participants

An initial 246 participants contributed to the statement generation in phase one of data collection and 112 participants engaged in the sorting and rating stage during phase two. The characteristics of the participants in each phase are summarized in Table 1.

[INSERT TABLE 1 HERE]

Statement Generation

During the statement generation phase, nine hundred and one techniques were reported. Due to the high number of psyching-up techniques, an initial synthesis was conducted by the first author (21). Should the process reported by the participant not appear to reflect a psyching-up strategy, or

if the process described by the participant was unclear the data was removed. This resulted in 64

unique techniques (listed in Table 2) that were used in the next phase. The three most reported

techniques were "*listening to music that makes you feel aggressive"* (n = 109*), "visualizing*

performing the lift successfully prior to execution" (n = 91), and "*inhaling sniffing salts"* (n = 71).

Statement Sorting

The participants sorted the 64 techniques into a mean 8.55 groups (SD = 4.2; range 2-18 groups).

Each group was then named by the participants.

Statement Rating

Participants rated all 64 techniques on perceived effectiveness (Table 2). Overall, the mean score of

all the techniques was 1.69 out of 4 (SD = 0.68). The three techniques that were perceived to be

most effective were technique 10, "*Visualizing performing the lift successfully prior to execution"* (M

= 3.08, SD = 0.95), technique 8: *"Sticking to your set routine prior to the lift (e.g. the order you put*

your kit on)" (M = 2.81, SD = 1.18), and technique 4: *"Clearing your mind"* (M = 2.71, SD = 1.15). The

three techniques that were perceived to be the least effective were: technique 15, *"Thinking about*

ancestors/religious persons suffering" (M = 0.38, SD = 0.82), technique 35 *"Listening to music that*

makes you feel sad" (M = 0.38, SD = 0.76), and technique 61: *"Visualizing a thrilling experience (e.g.*

being on a rollercoaster)" (M = 0.41, SD = 0.81).

[INSERT TABLE 2 HERE]

Concept Maps

Multidimensional scaling produced a point-cluster map, which visually represents the similarities between the psyching-up techniques based on participants' sorting data (Figure 1). The stress value was 0.09, which reflects a good representation (23), and is considerably lower than the average stress value of 0.29 in concept mapping research (21). To decide how to partition the clusters, we followed the guidance from Kane and Trochim (21) and selected 12 participants to review the dendrogram and identify how many meaningful clusters were presented from the diagram. Additionally, the mean number of groups created by the 112 participants within the sorting process (8.55) was also considered. Through this process, an eight-cluster map was chosen. To assign labels to the clusters, the names provided by the participants during sorting and rating stage were reviewed, in addition to consulting with eight respected strength sport coaches, and three sport psychology researchers, and two strength and conditioning researchers within the lead author's institution. The labels assigned to the eight clusters were: Cluster 1: *"pre-performance routines";* Cluster 2: *"positive thoughts, feelings, images, and behaviors";* Cluster 3: *"goals and performance accomplishments";* Cluster 4: *"self-deprecation";* Cluster 5: *"negative thoughts, feelings, images, and behaviors";* Cluster 6: *"stimulation";* Cluster 7: *"physical and physiological techniques";* Cluster 8: *"aggressive acts"* (Figure 2). As shown in Table 2 *"pre-performance routines"* had the highest mean effectiveness rating (2.30) of the clusters, and "*negative thoughts, feelings, images, and behaviors"* had the lowest mean effectiveness rating (0.75).

[INSERT FIGURE 1 HERE]

[INSERT FIGURE 2 HERE]

Supplementary Analysis

To consider the effect that sex, sport, and competitive level had on perceived effectiveness of the clusters, three one-way multivariate analyses of variance (MANOVA) were conducted. No significant differences in perceived effectiveness were identified between the preferred sports (Wilks' Lambda =0.89, F (15, 91) = 1.503, p = 0.166, d = 0.35) or competitive level (Wilks' Lambda = .845, F (23, 88) = 1.117, p = 0.341, d = 0.30). The MANOVA examining the differences in perceived effectiveness as a function of sex found a medium statistically significant difference between males and females, Wilks' Lambda = 0.80, F (15, 96) = 3.210, p = 0.003, d = 0.50.

Follow up univariate MANOVA revealed significant differences between males and females on the perceived effectiveness on four clusters. There was a medium effect size for Cluster 4, with males (M = 1.00, SD = 0.77) rating *"Self-deprecation"* as more effective than females (M = 0.59, SD = 0.57) F (1, 100) = 8.508, p = 0.004, d = 0.59. A medium effect for Cluster 5 was revealed, with males (M = 0.90, SD = 0.80) rating *"Negative thoughts, feelings, images", and behaviors"* as more effective than females (M = 0.45, SD = 0.58) F (1, 100) = 9.148, p = 0.003, d = 0.61. A medium effect for Cluster 6: was revealed, with males (M = 2.15, SD = 0.76) rating *"Stimulation"* as more effective than females (M = 1.76, SD = 0.82) F (1, 100) = 6.087, p = 0.015, d = 0.50. A large effect for Cluster 8 was revealed, with males (M = 2.14, SD = 0.84) rating *"Aggressive Acts"* as more effective than females (M = 1.42, SD = 0.88) F (1, 100) = 17.859, p < 0.001, d = 0.85.

DISCUSSION

The aim of the present study was to identify the psyching-up strategies used by athletes within strength sports, and to assess strength sport athletes' and coaches' perceptions of the impact that the strategies have on performance. Through utilizing a concept mapping approach, the present study identified a number of psyching-up techniques that are currently un-tested within strength sport research. A total of 64 unique techniques were identified during the initial statement generation

process, which were then grouped into eight separate strategies. Participants perceived that *"pre-performance routines"* were the most effective strategy for enhancing strength performance, whereas *"negative thoughts, feelings, images, and behaviors"* was perceived to be least effective. Additionally, the present study aimed to investigate if there were any demographic differences in the perceived assessments of the strategies. No significant differences were reported between the preferred sport, or competitive level, however there were differences found between the sexes. Specifically, males perceived the following strategies as more effective: *"self-deprecation"; "negative thoughts, feelings, images, and behaviors"; "stimulation"* and *"aggressive acts"* than females.

A key finding of the present study was that the various psyching-up techniques used by strength athletes and coaches converged upon eight distinct strategies (clusters). Typically, research has focused on just four psyching-up strategies: preparatory arousal, imagery, self-talk, and attentional focus (10,42). The 64 techniques reported in the statement generation of the current study did incorporate the four interventions, but the athletes and coaches grouped the techniques into various different strategies (clusters). For example, *"explicitly insulting yourself"* (technique 55) reflects a form of motivational self-talk and was classified as *"self-deprecation"*, whereas *"saying a self-affirmation"* (technique 54), which also reflects motivational self-talk, was grouped in *"positive thoughts, feelings, images, and behaviors"*. Further, the reported techniques included the use of imagery (technique: 39, 61, 53, 38, 1), self-talk (technique: 11, 41, 54, 21, 14, 13), and attentional focus techniques (technique: 42, 51, 25, 46). Moreover, various techniques (e.g., 2, 49, 30, 33, 21, 28) appear to have the intention to enhance psycho-physiological arousal. The aforementioned four strategies are still present within eight clusters, which could suggest that these strategies are typically recruited concurrently, and not in isolation.

A number of techniques identified in the present research do not meet the current definition of psyching-up (42). For example, the most reported psyching-up technique within this study was *"listening to aggressive music"* (n = 109). Additionally, this technique was perceived as one of the

most effective for enhancing strength performance (M = 2.55), as were *"inhaling sniffing salts"* (n=71; M= 2.29), *"ingesting caffeinated drinks"* (n= 13; M= 2.64) and *"blocking out the environment with headphones"* (n= 13; M = 2.32). Overall, 26 of the 64 techniques identified by participants are not self-directed cognitive strategies. These 26 techniques amassed 391 individual reports from participants, indicating that the existing definition (42) may not be an accurate representation of what psyching-up strategies entail to athletes and coaches. Consequently, we propose that psyching-up strategies in strength sports should be defined as "strategies intending to alter activation, or to enhance mental preparedness, immediately prior or during skill execution."

Participants perceived that the most effective strategy for enhancing strength performance was *"pre-performance routines"*. Similarly, a recent meta-analysis covering 15 sports found that pre-performance routines are effective for enhancing performance (37). A pre-performance routine is characterized as a sequence of task-relevant thoughts and actions that an athlete engages in systematically prior to the execution of their task (30). Through the incorporation of pre-performance routines, athletes can elicit an optimal emotional, high self-expectant, confident, and focused state immediately prior to and during execution (39). The *"pre-performance routines"* cluster comprised techniques with ritualistic properties, such as giving oneself a countdown prior to execution (technique 40), wearing the same clothing/footwear which one has associated with previous successful performance (technique 63), sticking to one's set routine (technique 8), and using a small body motion prior to or during execution (technique 43). Various techniques (e.g., technique: 4, 10, 26) within this strategy mirror elements of preperformance routines utilized in other sports such as golf (40), artistic gymnastics (6) and cricket (29). Given the high regard the participants placed on this strategy, in addition to the positive findings in other sports, strength athletes should develop a routine to perform before skill execution.

There were demographic differences in the perceived effectiveness of four strategies. Compared to females, males perceived the following strategies as more effective: *"self-deprecation"; "negative*

thoughts, feelings, images, and behaviors"; "stimulation" and *"aggressive acts"*. Examination of the techniques contained within these strategies suggest that the aim is to increase psycho-physiological arousal through using adverse emotions, stimulation, and aggression. An explanation for some of these sex differences in perceived effectiveness may be linked with anxiety and telic and paratelic states. During elevated states of arousal, an individual will perceive this psycho-physiological response as exciting or exhilarating whilst in a paratelic state, and anxiety whilst in a telic state (19). It has previously been proposed that telic-dominant individuals preference for low arousal states (22), may be due to possessing greater sensitivities to their biological anxiety systems (18). Indeed, previous research has indicated that greater levels of sensitivity to anxiety has a negative effect on performance in strength athletes (9), with females consistently being reported as presenting greater levels of sensitivity than males (e.g., 13,16). Additionally, a recent meta-analysis has also reported that female athletes experience greater levels of anxiety than males (34). In the context of psyching-up, therefore, individuals who are telic dominant may perceive strategies that increase psycho-physiological arousal as anxiety inducing, resulting in poorer performance.

The largest difference in perceived effectiveness between males and females identified in this study was for *"Aggressive Acts".* Beyond the previous explanations, we also propose that this difference in perceived effectiveness may be characterized by individual differences in trait aggression. It is well documented that males present greater direct aggression than females (e.g., 1,8,20). Therefore, the large sex differences reported for *"Aggressive Acts"* may reflect the differences in trait aggression possessed by the participants, as opposed to being specifically related to sex. That is, should a female possess greater aggressive traits, they may obtain performance enhancement from utilizing these strategies.

Despite the novel findings, the present study is not without limitations. The present study asked the participants to rate the effectiveness of each technique on a Likert scale. Although this presents valuable information regarding athletes' perceptions, it does not provide an objective measure of

which techniques, if any, exert the greatest benefit for performance. Second, the present study asked the participants to rate every technique, regardless of whether the participant had experienced the technique. Given that there were 64 techniques, it is unlikely that each participant had used each technique, thus potentially resulting in an inaccurate assessment of effectiveness. Finally, the present study calculated the perceived effectiveness of each strategy as the mean score of all techniques within a cluster. Consequently, this may not produce the most accurate representation of the participants' perceptions of an overall strategy.

To better understand the use and effectiveness of psyching up strategies, it is important that future research adopts a range of research designs and contexts. For example, investigating how psyching-up strategies are used in a natural setting (e.g., competition) will provide a greater insight into the methods used to enhance performance and their relative effectiveness. Further, examining the efficacy of strategies in experimental design will provide more control and strengthen causal inferences. Finally, to investigate our propositions regarding anxiety sensitivities and trait aggression, participants should complete personality measures prior to examining the efficacy of psyching-up strategies within a controlled environment to understand if these variables influence the efficacy of psyching-up strategies.

Using a concept mapping approach the present study identified 64 separate individual techniques that converge on eight psyching-up strategies. Further, we highlight several key points. First, "pre-performance routines" was perceived to be the most effective strategy for enhancing strength performance. Second, a large proportion of the techniques identified within the statement generation stage did not meet the previous definition of psyching-up (42). We propose that psyching-up strategies in the context of strength sports, should now be defined as "strategies intending to alter activation, or to enhance mental preparedness, immediately prior or during skill execution". Finally, the present article found that males typically perceived strategies that increased psychophysiological arousal as more effective than females. Overall, the study has identified a

diverse range of strategies that strength athletes could use to psych-up and provided important

insight into their perceived effectiveness on performance.

PRACTICAL APPLICATIONS

Based on the present findings, we suggest athletes adopt a pre-performance routine to be performed prior to an exercise. This routine should be consistently executed during training, to maximize performance enhancement during competition, or while testing a maximal effort in training. Pre-performance routines have previously been shown to enhance performance in a wide variety of sports (37), in addition to being ranked as the most effective psyching-up strategy within our sample of experienced strength athletes and coaches. Athletes could utilize one or more of the techniques highlighted by our participants within the "pre-performance routines" strategy. It is advised that routines developed for the strength athlete can be replicated in different training facilities and in competition settings also. An example of this could be an athlete following a set order in which they apply their lifting equipment followed by a small body motion such as a head nod and finishing with an internal countdown prior to the lift. Through repeating this same sequence, an athlete can enhance their confidence and elicit an optimal emotional state leading to enhanced performance. Further, should an athlete wish to increase their psycho-physiological state, techniques identified in the "stimulation", "physical and physiological techniques" or "aggressive acts" strategies should be used over those contained within "self-deprecation" and "negative thoughts, feelings, images, and behaviors". Through incorporating the strategies listed above, it is suggested that athletes may gain performance enhancement on their strength performance. Should these strategies be incorporated by athletes outside of strength sports, the enhancement in strength performance within the confounds of a training regime may result in greater development to overall athleticism and sporting performance. Finally, as previous findings (10) show that free-choice psyching-up demonstrates the greatest consistency in enhancing maximal force production, we would advise that athletes are given autonomy in selecting their own techniques and strategies to psych-up.

ACKNOWLEDGEMENTS

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Table 1. Participant characteristics by phase

Characteristic	Statement Generation	Statement Sorting and Rating
Sex		
Male	143	75
Female	103	37
Age Range		
18-24	29	13
25-34	103	54
35-44	59	31
45+	55	14
Role		
Athlete	201	89
Coach	2	1
Both	43	22
Sport		
Strong(wo)men	105	68
Powerlifters	117	39
Olympic Weightlifters	19	5
Others	5	0
Competitive Level		
Regional	53	23
National	92	48
International	101	41

Table 2. Statements by clusters

Cluster Statement	N	Mean Rating 0 - 4 (SD)
Cluster 1: Pre-Performance Routines		**2.30 (0.61)**
40 Giving yourself a countdown prior to execution (e.g. 3 - 2 - 1 lift it).	1	1.63 (1.24)
42 Hyper-focusing your attention on a certain spot/person/thing in the room.	8	2.05 (1.24)
49* Blocking out the environment (e.g. turning the speakers up, using headphones).	13	2.32 (1.30)
60* Technical verbal instructions, from somebody else (e.g. friend/coach).	3	2.36 (1.13)
63* Wearing the same clothing/footwear which you have associated with successful previous lifts.	1	2.21 (1.40)
51 Thinking about cues outside of the body (e.g. punching the bar away, the floor is lava).	4	1.95 (1.26)
22* Watching videos of yourself doing the event/lift successfully.	5	2.15 (1.27)
8 Sticking to your set routine prior to the lift (e.g. the order you put your kit on).	28	2.81 (1.18)
20 Isolating yourself in the moments prior to execution.	9	2.37 (1.12)
26 Slow deep breaths.	55	2.19 (1.23)
11 Repeating a positive word internally (e.g. repeatedly saying "yes" in your head).	3	2.43 (1.13)
43 Using a small body motion (e.g. head-nod, twitch) prior or during the execution.	3	1.79 (1.38)
25* Thinking about instructional cues inside your body (e.g. engaging a muscle group).	13	2.54 (1.09)
46 Focusing on your mental cue checklist.	13	2.29 (1.08)
4 Clearing your mind.	27	2.71 (1.15)
10 Visualizing performing the lift successfully prior to execution.	91	3.08 (0.95)
Cluster 2: Positive thoughts, feelings, images and behaviors		**1.45 (0.64)**
57* Verbal Encouragement from somebody else (coach/friend, etc.).	5	2.55 (1.15)
62 Presenting yourself in a power stance.	1	1.38 (1.34)
18* Listening to music that makes you feel upbeat/happy.	13	2.02 (1.23)
58* Listening to music that makes you feel chilled/relaxed.	2	1.10 (1.15)
41 Stating a motivational statement prior or during the execution of a lift (e.g. I can do this).	24	1.94 (1.20)
39 Visualizing being given divine/superhuman powers prior to execution.	1	0.84 (1.19)
61 Visualizing a thrilling experience (e.g. being on a rollercoaster).	1	0.41 (0.81)
54 Saying a self-affirmation (e.g. telling yourself you are the best in the world).	24	1.73 (1.30)
64 Dismissing/downplaying the magnitude of the lift.	1	1.12 (1.11)
27* Watching videos of other athletes who you draw inspiration/motivation from.	3	1.48 (1.15)

53	Visualizing being in front of a crowd (in training).	1	1.41 (1.27)
Cluster 3: Goals and performance accomplishments			**1.57 (0.83)**
52	Focusing about how much you want to achieve your goals.	9	1.98 (1.20)
56	Thinking about previous successful lifts.	6	2.25 (1.28)
16	Thinking about the work/commitment has gone into training	9	1.51 (1.13)
17	Thinking about your desire to leave a legacy, locally (family, friendship group) or globally (worldwide).	3	1.24 (1.18)
47*	Watching scenes/speeches from films.	4	0.89 (1.12)
31	Reminding yourself of previous challenges that you have overcome.	5	1.79 (1.27)
34	Thinking about how much you love the sport.	1	1.59 (1.36)
23	Thinking of making loved ones proud.	2	1.68 (1.25)
45*	Listening to motivational videos/speakers/podcasts.	4	1.23 (1.18)
Cluster 4: Self-deprecation			**0.87 (0.74)**
38	Visualizing that the equipment is insulting you.	1	0.46 (0.92)
55	Explicitly insulting yourself (e.g. you're a piece of sh*t).	5	0.68 (1.24)
2*	Pre-agreed verbal statement from somebody else, with the goal of evoking anger.	2	1.46 (1.12)
Cluster 5: Negative thoughts, feelings and images and behaviors			**0.75 (0.77)**
1	Visualizing a scenario where the lift can save a loved one from danger.	13	1.48 (1.43)
35*	Listening to music that makes you feel sad.	6	0.38 (0.76)
50	Thinking about 'haters' and proving them wrong.	2	0.91 (1.28)
15	Thinking about ancestors/religious persons suffering.	2	0.38 (0.82)
48	Focusing on the fear or shame of failing.	7	0.63 (1.12)
30	Thinking about negative events currently going on in your life.	7	0.68 (1.17)
33	Thinking about historic negative events that you have experienced.	15	0.83 (1.24)
9*	Listening to music that you associate with grief.	1	0.75 (1.07)
Cluster 6: Stimulation			**2.02 (0.80)**
32*	Listening to music that makes you feel arrogant/confident.	3	2.12 (1.31)
37*	Creating an atmosphere/crowd to provide loud encouragement while you execute the lift.	14	2.31 (1.32)
21	Internally stating an explicit motivational statement (e.g. saying "let's f**king go" in your head before execution).	3	2.31 (1.27)
28*	Taking stimulants (e.g. caffeine tablets/pre-workouts).	13	2.64 (1.18)
44*	Pinching your earlobes.	4	0.72 (1.07)
Cluster 7: Physical and physiological techniques			**1.86 (0.80)**
3*	Bouncing/Jumping/Spinning before the lift.	15	1.80 (1.04)

7*	Pacing.	10	2.06 (1.21)
5	Fast, short breaths.	36	2.03 (1.23)
19*	Clamping down on a mouthpiece.	3	1.54 (1.26)
Cluster 8: Aggressive Acts			**1.90 (0.92)**
12*	Inhaling Sniffing salts.	71	2.29 (1.29)
14	Screaming/yelling an explicit motivational statement out loud (e.g. screaming "let's f**king go" out loud before execution).	13	2.04 (1.29)
6	Screaming/Loud Grunting.	37	2.11 (1.26)
13	Screaming/yelling a positive statement out loud (e.g. screaming "yes" out loud before execution).	7	2.06 (1.16)
24*	Listening to music that makes you feel aggressive (e.g. metal, heavy rock etc.).	109	2.55 (1.37)
29*	Being slapped (by yourself, or a training partner/coach).	56	1.71 (1.36)
59*	Shaking/attacking the bar.	5	1.53 (1.36)
36*	Headbutting something.	13	0.90 (1.15)

N= the number or participants who reported this technique during the statement generation process

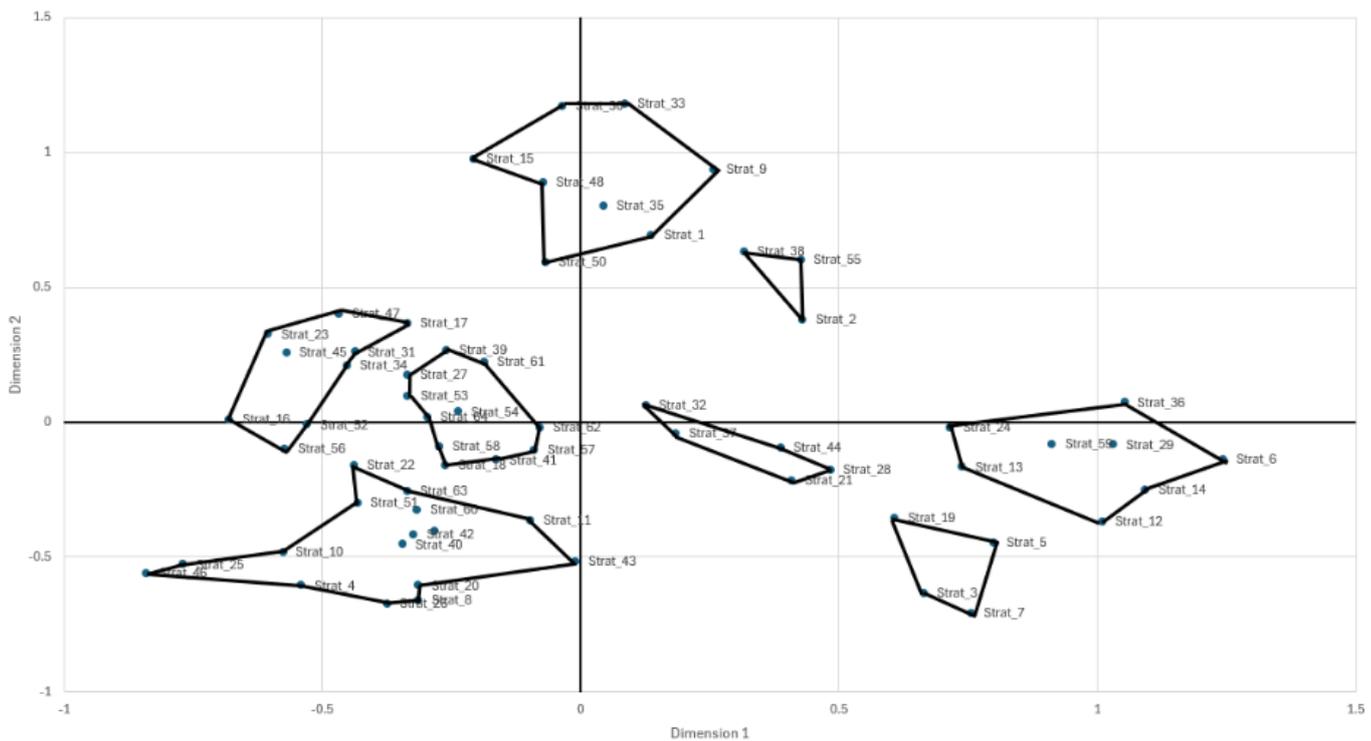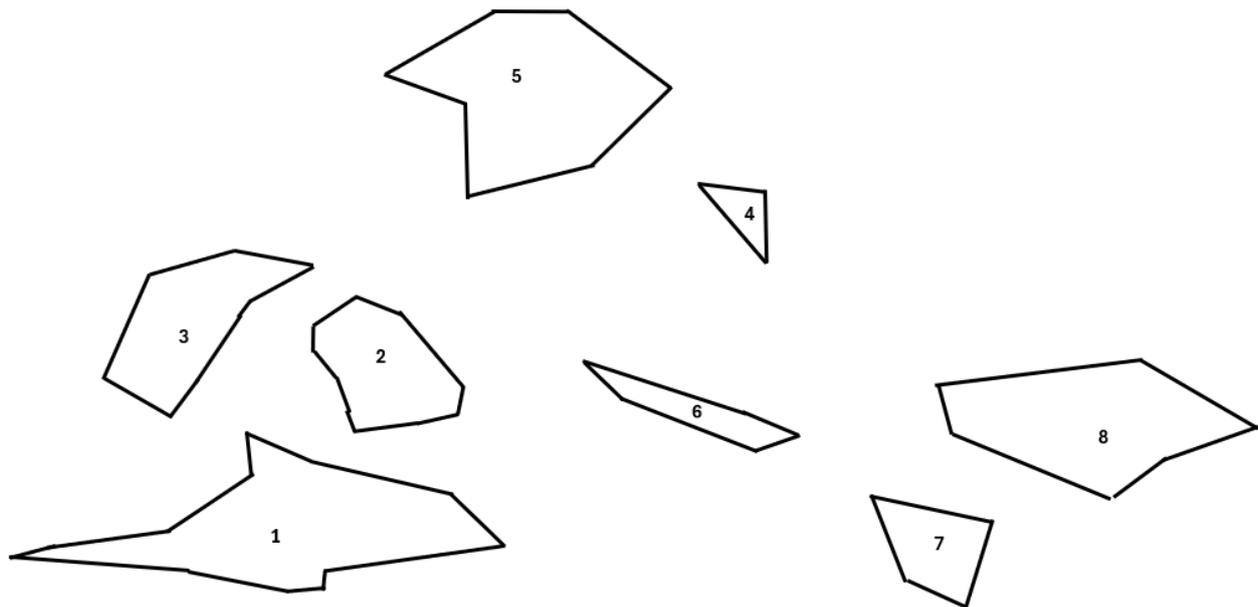*= Techniques that would not meet the previous definitions of psyching-up.*

Figure 1. Cluster Map of psyching-up strategies with position of each technique

1 - Routines
2 - Positive thoughts, feelings and images
3- Goals and performance accomplishments
4 - Self-derecation
5 - Negative thoughts, feelings and images
6 - Stimulation
7 - Physical and physiological techniques
8 - Aggressive Acts

Figure 2. Cluster map of psyching-up strategies with cluster labels