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RESEARCH ARTICLE

Validating The Self-Talk Questionnaire of Athletes and How it Affects Athletes' Mental Toughness?

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Abstract
This research could have significant implications for improving mental conditioning practices in sports. By establishing the validity of this questionnaire, researchers and coaches can better understand the relationship between self-talk and mental toughness, leading to more effective interventions and training programs that enhance athletes' resilience and competitive edge. This study aimed to validate its psychometric properties to detect the self-talk of athletes and how it affects their mental toughness. The participants were 93 Athlete in martial arts and game sports (83 Male and 10 Female with Age; M=24.35, SD=7.338) in Bekasi, Indonesian athletes. Data were collected randomly in an online form. Rasch analysis was utilized to evaluate the validity and reliability of the self-talk questionnaire in the Indonesian version with 5 Likert scales, and linear regression was used for hypothesis analysis. The results showed that the self-talk questionnaire in the Indonesian version achieved validity and reliability criteria based on Rasch parameters with five rating scales. The questionnaire data revealed strong positive connections between self-talk and mental toughness. Challenge had the largest effect on negative self-talk, while control had the largest effect on positive self-talk. In conclusion, self-talk has a significant impact on athletes' mental toughness.

Keywords
Self-Talk, Mental Toughness, Athlete, Sport Psychometric

INTRODUCTION

The four training factors that need to be prepared for every sports training program are physical, technical, tactical, and mental (Tudor et al., 2015). In the competition phase, mental factors significantly affect athlete performance (Raglin, 2001). Self-talk is an applicable mental training method (Crust and Azadi, 2010; Kahrović et al., 2014). Internal dialogue, internal monologues, verbal exercises, and all-encompassing self-statements, focusing on oneself automatically and intentionally through thoughts, characterize self-talk (Mohiyeddini et al., 2011), leading athletes to achieve their goals (Hatzigeorgiadis, 2008). In sports, self-talk has been characterized as

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multidimensional verbalizations directed at oneself that provide content information and have at least two functions: instructive and motivating (Hardy et al. 2001; Tangkudung 2018).

Self-talk has been identified as an important psychological approach employed by psychologically tough athletes (Crust and Azadi, 2010). Self-talk can be closed so that it is not heard by others or open, which can be heard by others and addressed by oneself. Self-talk comprises both positive and negative statements. Both have different effects on athlete performance. Some results have shown that self-talk affects other psychological factors, one of which is mental toughness. Mental toughness is a multidimensional concept consisting of cognitive (e.g., attention), emotional (e.g., emotional intelligence), and behavioral (e.g., consistent performance) components. Owing to its apparent importance in athletes' performance in sports, mental toughness has recently become a psychological phenomenon of great interest. Given its recent definition, there is limited literature on mental toughness. Nonetheless, the need for more mentally tough athletes necessitates further study of particular psychological tactics (Georgiadis et al., 2024) that aid in the development of mental toughness in sports. Validating the self-talk questionnaire for athletes is an urgent research priority because self-talk is a critical psychological tool that influences mental toughness, a key factor in athletic performance. Accurate and reliable measurement of self-talk can provide valuable insights into how athletes regulate their thoughts, manage stress, and maintain focus under pressure. By establishing the validity of this questionnaire, researchers and coaches can better understand the relationship between self-talk and mental toughness, leading to more effective interventions and training programs that enhance athletes' resilience and competitive edge.

The present investigation focused on analyzing the self-talk and mental toughness levels of athletes following a coach-led mental toughness intervention. It was anticipated that the intervention would enhance athletes' use of self-talk and mental toughness levels and that there would be a significant correlation between the two. We hypothesized that a customized strategic self-talk approach would prove beneficial for mental toughness.

MATERIALS AND METHODS

Research Questions

This study aimed to evaluate the psychometric properties of self-talk questionnaires and the mental toughness of athletes. The data were analyzed using the Rasch measurement method with the software WINSTEPS 5.2.5.1 software (Linacre, 2022). The following research questions were formulated to guide the research objectives of this study:

1. What is the extent of the reliability and validity of the self-talk questionnaire?
2. How does self-talk affect athletes' mental toughness?

Participants and Procedures

A quantitative method with a Rasch analysis design was utilized in this study, with two-step data collection procedures on 93 Athlete athletes in martial arts and game sports (83 Male and 10 Female with Age; M=24.35, SD=7.338) Bekasi, Indonesian athletes were participated randomly in filling the self-talk questionnaire . The original sentence is rephrased below to improve language quality and clarity while maintaining the same meaning. The questionnaire, administered online, employed a rating scale with five categories ranging from 1 (never) to 5 (always) and targeted athletes in Bekasi, West Java, Indonesia.

Ethical clearance No. E.1.078/UNISMA. LPPM/E/V/2024 for this research was obtained from the LPPM Universitas Islam 45 Bekasi, Indonesia. Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participant rights. The research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures, and confidentiality measures.

Instruments

A background questionnaire was used to collect participant information, such as gender and age. The dimension self-talk questionnaire was used refers to Automatic Self-Talk Questionnaire for Sports (ASTQS) (Zourbanos et al., 2009) consists of 20 items and The mental toughness questionnaire consists of 27 items with 5 Likert scales from 1 (never) and 5 (always) (Haqiyah et al., 2023; Wolter et al., 2022). All instruments were translated into the Indonesian version to address language barriers, clear the ambiguity of meaning,

provide language access, and avoid participants' misunderstandings. All instruments were checked based on content validity by two experts in English language majors before the test administration.

Table 1. Self-Talk Questionnaire

Dimensions of self-talk	Statement
Negative1	I am not as good as the others
Negative2	What will others think of my poor performance
Negative3	I'm wrong again
Negative4	I cannot concentrate
Negative5	I am tired
Negative6	My body is not in good condition
Negative7	My legs/arms are shaking from tiredness
Negative8	I am Hungry
Negative9	I want to take a shower
Negative10	I think "what will I do later tonight"
Positive1	I feel strong
Positive2	I am very well prepared
Positive3	I am not stress
Positive4	I believe in me
Positive5	I believe in my abilities
Positive6	I can make it
Positive7	I can keep going
Positive8	I can concentrate in my goal
Positive9	I can focus on my technique
Positive10	I can focus on what I need to do in competition

Data analysis

SPSS software V26, developed by IBM Corp in 2017, was employed to perform descriptive statistics and generate participant demographic profiles. Furthermore, the WINSTEPS software version 5.2.5.1, utilized (Linacre, 2022), was employed to perform psychometric evaluation and rating improvement using Rasch analysis.

RESULTS

Validity

The validity of the mental toughness questionnaire was evaluated using the Rasch analysis. Item and person parameters were assessed based on the mean of the infit and outfit mean square (MNSQ), with an acceptable range of 0.5 to 1.5. Although 1.6, is still considered acceptable if the point-biserial correlation (PTMA) is positive, it is important to note that this range may vary depending on the specific context and research objectives (Boone et al., 2014; Park & Liu, 2019). In this study, the fit validity criteria can be considered reliable because of the large sample size, which makes it possible to disregard the infit and outfit z-standardized (ZSTD) values for persons and items (Linacre, 2021). To confirm the existence of more than two distinct groups based on both person ability and item difficulty level, it is important for the separation values of items and persons to be greater than 2 logits.

Table 2 summarizes the Rasch parameters for the Indonesian version of the self-talk questionnaire. The fit validity criteria for both the individual and item in both studies were determined based on the infit and outfit mean squares (MNSQ), which ranged from 1.00 1.06. Additionally, item and person separations were both above two logits. The aim was to evaluate the unidimensionality and local independence of the inductive reasoning test to establish its construct validity. The table provided shows the raw variance by measure for all tasks, with any values of raw variance below 30% being accounted for by the measures, and the remaining unexplained variance shown in the first

contrast with a value below 2 (Linacre, 2021). The Yen Q3 statistics were utilized to determine the raw residual correlation (Christensen et al., 2017). The sentence suggests that there is no local independence present, as the raw residual correlation is less than 0.4.

Table 2. The summary of rasch parameters for self-talk questionnaire

Psychometrics Attribute	Subscale		Self-Talk Questionnaire
	Negative	Positive	
Number of Items	10	10	20
Mean			
Item Outfit MNSQ	1.00	0.96	1.00
Item Infit MNSQ	1.00	0.94	1.01
Person Outfit MNSQ	1.01	0.96	1.00
Person Infit MNSQ	1.00	1.13	1.09
Item Separation	2.64	5.61	4.78
Person Separation	1.47	1.95	1.94
Item Reliability	0.93	0.83	0.90
Cronbach's Alpha	0.68	0.94	0.78

To guarantee the validity of the items, an investigation of the item measures and fit criteria is presented in Table 3. The range of the item measures spans from -1.08 to 1.39 logits, while the Outfit MNSQ values range from 0.60 to 1.44 logits. These findings confirm that the self-talk questionnaire was reliable for all items in both studies.

Table 3. Item measure and fit criteria

Item number	Measure (logits)	Outfit MNSQ	PTMA
Negative1	0.47	0.8051	0.32
Negative2	0.72	1.411	0.292
Negative3	0.34	0.5925	0.4335
Negative4	0.3	0.669	0.4256
Negative5	0.41	0.6081	0.5264
Negative6	0.11	0.7407	0.4083
Negative7	-0.17	1.2585	0.4134
Negative8	-0.17	1.3898	0.2946
Negative9	0.5	1.5447	0.3575
Negative10	0.41	1.2498	0.2606
Positive1	0.52	1.5802	0.3626
Positive2	0.24	0.9099	0.6241
Positive3	1.02	2.193	0.2383
Positive4	-0.95	0.7285	0.6024
Positive5	-1.12	0.7395	0.5257
Positive6	-0.63	0.6392	0.6418
Positive7	-0.65	0.8238	0.5579
Positive8	-0.7	0.5672	0.6275
Positive9	-0.3	0.6151	0.7202
Positive10	-0.36	0.8357	0.5374

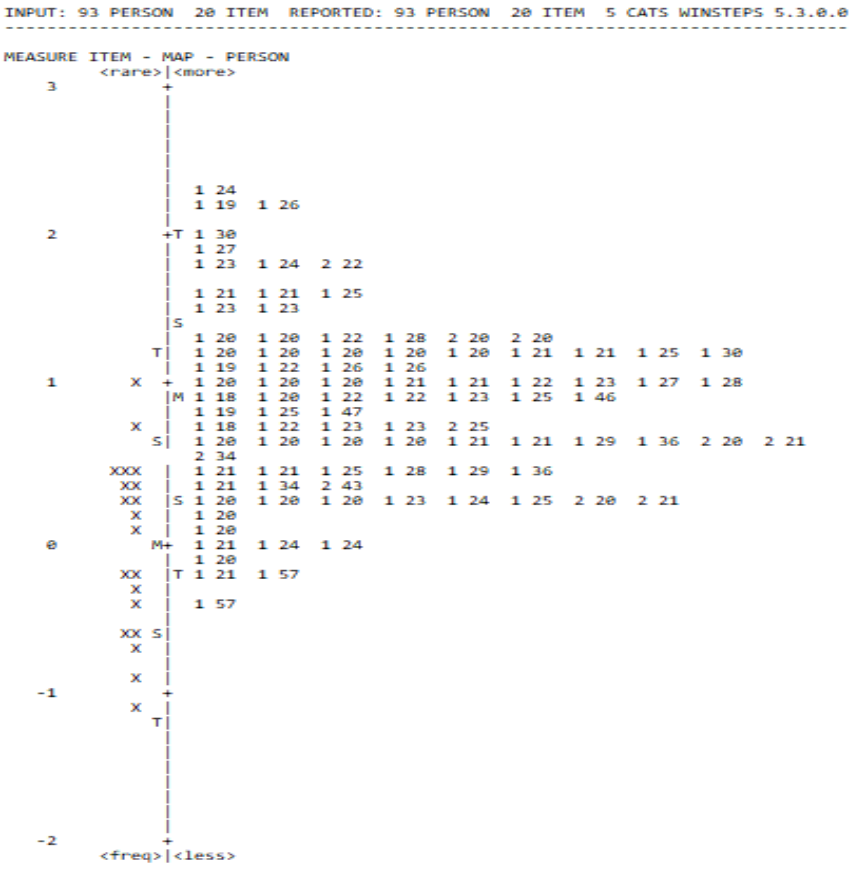

Figure 1. Person-item wright map

The item-person map is a useful tool in studies that aim to investigate the relationship between items and individuals. In Figure 1, it is evident that most participants possessed higher abilities than the item difficulty level, which supports the idea that athletes engage in positive self-talk. Furthermore, we conducted Item Characteristic Curve (ICC) analyses at the instrument level. The ICC plot reveals that both studies align with the Rasch probability model as the empirical and expected lines converge or overlap, as shown in Figure 2.

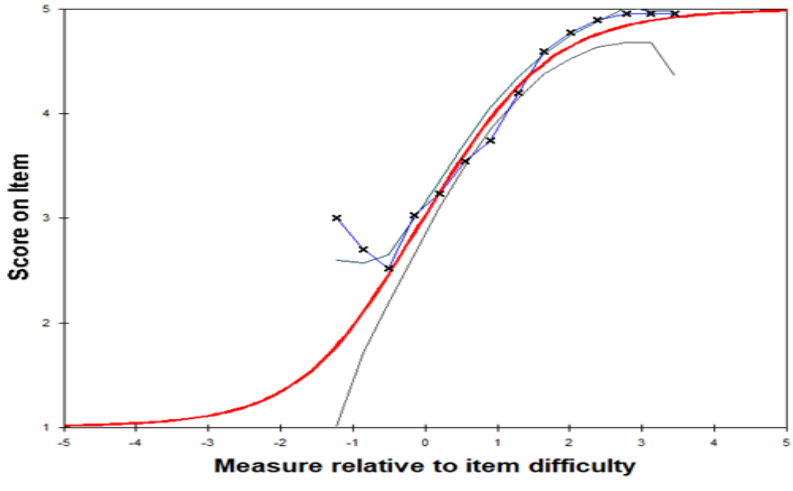

Figure 2. ICC plot*;* category probability of the self-talk Questionnaire

Reliability

The criteria for evaluating item reliability were based on both item reliability and Cronbach's alpha (α). All items in the self-talk questionnaire as well as each dimension were analyzed. The item reliability values for both studies ranged from 0.98 to 0.99, demonstrating a high level of reliability (Fisher, 2007). Cronbach's alpha, denoted by α,

measures the internal consistency of a set of items; in this case, it has a value of 0.87. For clarity, it is important to note that the minimum acceptable value for Cronbach's alpha is 0.6 (Taber, 2018). The outcome validates the dependability that arises from Cronbach's alpha measurements. To answer the second research question, how does self-talk affect an athlete's mental toughness? used linear regression to assess the relative effect of a predictor variable on a certain outcome (Pak & Oh, 2010). Challenge had the greatest effect on negative self-talk, while control had the greatest effect on positive self-talk (Table 4).

Table 4. Output regression

Aspect	Unstandardized B	
	Negative	Positive
Constant	22.443	18.690
Control	.118	.563
Commitment	.163	.479
Challenge	.249	.031
Confidence	.173	.284

DISCUSSION

The research hypothesis was validated by statistical data analysis, and additional investigation is necessary to completely understand the research results. The dependability and legitimacy of the self-talk questionnaire were substantiated by research. Self-talk has been found to have a positive impact on an athlete's mental toughness as it can improve performance quality, self-confidence, concentration, and motivation (Cox et al., 2003). Self-talk is closely related to self-awareness and self-efficacy, and plays a role in self-regulation, personal intelligence, and emotional intelligence (Mohiyeddini et al. 2011). Interventions that include self-talk training have been found to be more effective than those that do not include self-talk training (Hatzigeorgiadis et al., 2011a). Therefore, evidence suggests that self-talk can be an effective strategy for enhancing an athlete's mental toughness and performance (Coulter et al., 2010).

The study found that all three interventions resulted in a performance increase, with the greatest increase found in the assisted positive self-talk condition (Hamilton et al., 2007). A study conducted by Hatzigeorgiadis et al. discovered that instructional self-talk was more beneficial for precise tasks than motivational self-talk (Hatzigeorgiadis et al., 2011b). Fine tasks benefit more from self-talk than gross tasks do. According to a study, self-talk was incorporated into a multi-intervention package that resulted in enhanced skill performance and psychological well-being (Cumming et al., 2006).

Sheard (2010) defined mental toughness as the philosophy behind sports success in a recent book; when presented as an attitude, mental toughness appears to change through mental skills training. The results of the questionnaire revealed strong, positive connections between mental toughness and the use of several psychological strategies (i.e., goal-setting, imagery) (Crust & Clough, 2011) and sel talk (Cooper et al., 2021; Ede et al., 2020). Self-talk is an important aspect of training and competition at all levels, and the athlete's ability to generate positive self-talk is one of the most important elements impacting the performance of many sports skills (Mostafa, 2015), and is one of the methods previously identified as potentially impacting mental toughness (Cooper et al., 2021); however, further experimental research is required.

Self-talk can change or control behavior, and negative thinking can become positive, which increases athletes' concentration and shooting accuracy (Rizal et al., 2021). Positive self-talk, sometimes known as internal conversation, can be carried out either silently or aloud, and serves as a means for individuals to instruct or fortify themselves (Ohuruogu et al. 2022). Studies have found self-talk to be an effective mental training approach that can positively or negatively impact an athlete's performance depending on their emotions (Basset et al., 2022). By contrast, negative self-talk often sends pessimistic messages to the mind, leading to a decline in cognitive anxiety and academic performance (Liu et al. 2021). A study found that positive self-talk can induce physiological changes (Muhamad, M et al., 2019; Tangkudung et al., 2021) and facilitate autonomic regulation of cardiorespiratory function (Basset et

al., 2022). In conclusion, self-talk can significantly impact athletes' mental toughness and performance.

Positive self-talk can increase concentration and shooting accuracy and induce physiological changes, while negative self-talk can lead to a decline in cognitive anxiety and academic performance. Coaches should encourage their athletes' perceptions of autonomy and competence to produce more positive self-talk in competition, which can result in higher levels of performance. (Amado et al., 2019). According to research, self-talk has a significant impact on athletes' mental toughness (Yalçın & Turan, 2021). Self-talk is a mechanism that can help athletes put in more effort, and studies have shown that athletes who engage in task-specific self-talk have a positive effect on their physical performance (Bingöl & Yıldız, 2021). Mental toughness is a person's attitude or self-evaluation, particularly among athletes, to overcome barriers, challenges, and even pressures in order to maintain attention and motivation that decides a positive energy to reach a goal of surviving during the competition (Jannah et al., 2018). Athletes who possess mental toughness have several indicators, including the ability to face challenges, learn from bad experiences, self-confidence, anwithvels of depression, anxiety, and stress. When thletes have good mental toughness, they are expected to increase their commitment to continue playing an active role and strive to improve their inner performance (Faizah, 2021).

The results show that the self-talk questionnaire in the Indonesian version achieves validity and reliability criteria based on Rasch parameters with five rating scales, and there is a relationship between self-talk and mental toughness. This might be because the questions were primarily made up of the four mental toughness characteristics (4C), which are used to identify athletes based on the four aspects of mental toughness: control, commitment, challenge, and confidence (Alshuraymi & Hastie, 2024). Other elements may be included if assessment is required to identify people with other features or conditions. Challenge had the largest effect on negative self-talk, while control had the largest effect on positive self-talk. Athletes have a tendency to see problems and challenges as something they must overcome. The capacity of an athlete to guide and manage himself to attain their goals is referred to as control (Clough et al., 2002). In summary, self-talk has a significant impact on the mental toughness of athletes, and athletes who have good mental toughness have several indicators, including the ability to face challenges, learn from bad experiences, self-confidence, and low levels of depression, anxiety, and stress.

Developing positive self-talk necessitates a strong mental toughness dimension, which refers to an athlete's capacity to guide and control their thoughts and behaviors towards achieving their goals. By expressing optimistic statements, positive responses can be elicited (Weinberg & Gould, 2011). Studies conducted by Wadey and Hanton have explored the relationship between the utilization of fundamental psychological skills, such as goal setting, self-talk, imagery, and relaxation, as well as the direction and intensity of athletes' anxiety levels (Wadey & Hanton, 2008; Weinberg & Gould, 2011).

This study aimed to evaluate the advantages of self-talk and instructional strategies in comparison to a control condition. Studies have provided robust experimental evidence to support the effectiveness of self-talk as a helpful intervention or coping strategy for improving athletic performance (Antonis et al., 2004; Perkos et al., 2002; Theodorakis et al., 2001) and can decrease distraction. Negative self-talk can have a detrimental effect on athletes by eliciting unfavorable emotional responses. Research has shown that negative self-talk can lead to decreased performance in athletes as it creates tension, raises pressure, and fosters anxiety, anger, worry, sadness, despair, and heightened expectations for optimal outcomes. Athletes may also experience a sense of failure that could negatively impact their overall mental toughness, which refers to their ability to view challenges and obstacles as opportunities to be overcome rather than avoided.

Conclusions

The self-talk questionnaire was validated by Rasch analysis, using a rigorous quantitative method. Rasch analysis was used to assess the validity and reliability of the questionnaire. The results showed that the self-talk questionnaire in the Indonesian version achieved validity and reliability criteria based on Rasch parameters with five rating scales. The conclusions of the questionnaire data investigation revealed substantial positive links between self-talk and mental toughness. Challenge had the largest effect on negative self-talk, while control had the largest effect on positive self-talk.

It is recommended to integrate this validated tool into regular assessments of athletes' psychological training programs. Coaches and sports psychologists should utilize the questionnaire to monitor and enhance athletes' self-talk patterns, focusing on strategies that reduce negative self-talk and promote positive self-talk, particularly in areas related to challenge and control. Additionally, incorporating targeted interventions that address specific self-talk patterns could further strengthen athletes' mental toughness, ultimately leading to improved performance under pressure. Future research should explore the application of this tool across different sports and cultural contexts to ensure its broader relevance and effectiveness.

Conflict of İnterest

The authors declare no conflict of interest.

Ethical Statement

Ethical clearance No. E.1.078/UNISMA. LPPM/E/V/2024 for this research was obtained from the LPPM Universitas Islam 45 Bekasi, Indonesia.

Author Contributions

Study Design, AH, SS; Data Collection, DA, BB, DNR, and PP; Statistical Analysis, AH, SS, and YNH; Data Interpretation, MST,; Manuscript Preparation, WDL and PP; Literature Search, RB. All authors have read and agreed to the published version of the manuscript.

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