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The Effect of Mental Toughness on Decision Making in West Java PPLP Gymnasts

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Abstract

Gymnastics is a closed-skill sport that demands an extremely high level of movement precision, complex routines, and full concentration. In the context of elite competition, the ability to make quick and accurate decisions is often associated with the athletes' mental toughness when facing high pressure from judges and performance expectations. This study aimed to empirically examine the effect of mental toughness on decision-making skills in elite gymnasts. This research used a correlational quantitative approach. The subjects were the entire population of 11 athletes from the West Java Student Sports Education and Training Center (PPLP) for gymnastics, selected using the total sampling technique. Data were collected systematically using the standardized Sports Mental Toughness Questionnaire (SMTQ), which measures confidence, constancy, and control, alongside an adapted decision-making questionnaire by Leykin & DeRubeis. Descriptive statistical analysis revealed a homogeneous phenomenon, where the majority of athletes (72.7%) had uniform levels of mental toughness and decision-making skills in the medium category. Based on the Shapiro-Wilk normality prerequisite test, the data distribution was partially not normal. Therefore, hypothesis testing was carried out using Kendall's Tau-b non-parametric statistical analysis. The test results showed a correlation coefficient of -0.200 with a significance value (p-value) of 0.420 ($p > 0.05$). These results conclude that statistically, there is no significant effect of mental toughness on decision-making skills in West Java PPLP gymnasts. These in-depth findings indicate that in closed-skill sports such as gymnastics, elite-level athletes tend to have reached an established stage of movement automation. Therefore, the effectiveness of decision-making in the field is dominated more by technical maturity and internalized muscle memory repetition, rather than by independent fluctuations in psychological variables.

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INTRODUCTION

In competitive sports, elite performance is significantly influenced by an athlete's psychological stability and mental readiness (Weinberg & Gould, 2023). Decision-making in sports is a vital cognitive process that requires athletes to evaluate situations and execute the best actions within a very narrow timeframe (Ashford et al., 2021). The effectiveness of this process is often considered a reflection of an athlete's psychological maturity when under competitive pressure.

One of the psychological pillars considered most decisive for performance is mental toughness. Mental toughness is universally recognized as a fundamental psychological attribute that helps athletes cope with competitive stress (Crust, 2007). The development and maintenance of this toughness are crucial for persevering under intense pressure (Connaughton et al., 2008) The concept of mental toughness developed by Clough et al. (2002) through the 4C model (Control, Commitment, Challenge, Confidence) emphasizes that mentally tough athletes have the advantage of remaining calm, consistent, and possessing clear emotional control amidst high stressors (Clough, P. J., Earle, K., & Sewell, D. 2002). This psychological construct involves multidimensional aspects that shape the athlete's overall resilience trait (Gucciardi et al., 2015)

In the context of decision-making, the theoretical framework by Leykin & DeRubeis (2010) emphasizes the importance of an individual's ability to evaluate various alternative actions effectively to achieve desired goals. In gymnastics, every minor error or balance disruption on the apparatus requires the athlete to make instant decisions to continue the routine with minimal point deductions.

However, there are striking differences in cognitive characteristics across various sports. In closed-skill sports such as gymnastics, decision-making tends to be an automatic response to a pre-planned movement scheme that has been repetitively trained (Zheng, 2024). This differs from team sports (open-skill), where the environment is unpredictable, thus demanding more dynamic cognitive adaptation.

This phenomenon is clearly visible through observations of athletes at the West Java Student Sports Education and Training Center (PPLP) for gymnastics at GOR Arcamanik. The highly strict and repetitive training routines aim to build absolute muscle memory. During competitions, athletes often execute recovery maneuvers instantly without going through a prolonged cognitive weighing process, indicating that technical maturity may dominate over situational mental fluctuations.

The novelty of this study lies in its specific focus on evaluating the limits of mental toughness in a highly automated, closed-skill sport at the elite level, a demographic and context that is frequently underrepresented compared to dynamic team sports. While the majority of sports psychology literature focuses more on the influence of mental toughness in dynamic team sports (Cowden, 2017), this research is present precisely to test the limitations of this variable's influence on elite athletes in a highly structured and automated sport.

Although mental toughness is still considered a crucial variable, the theoretical gap regarding the extent of its influence on previously programmed movements remains an academic debate (Miao et al., 2024). Therefore, this study aims to empirically analyze the effect of mental toughness on the decision-making of West Java PPLP gymnasts, with the initial hypothesis of a significant effect.

METHOD

This study applied a quantitative approach with a correlational method aimed at analyzing the relationship between variables without any manipulation or intervention. This design was selected to examine the extent to which psychological variables interact with cognitive performance in the context of physical activity (Vaughan et al., 2018). The research subjects were the entire population of athletes at the West Java Student Sports Education and Training Center (PPLP) for gymnastics, totaling 11 individuals. consisting of 7 female and 4 male athletes. The participants' ages ranged from 13 to 18 years old. Given the limited population, the sampling technique used was total sampling or saturation sampling, which allows researchers to make generalizations with a minimal error rate in small groups (Arikunto, 2010)

The research objects included mental toughness as the independent variable and decision-making as the dependent variable. Measurements were conducted using two validated Likert-scale questionnaire instruments. The mental toughness variable was measured using the Sports Mental Toughness Questionnaire (SMTQ) developed by Clough et al. (2002) to assess the dimensions of confidence, constancy, and control. Meanwhile, the decision-making variable was

measured through an adaptation of the Leykin & DeRubeis (2010) questionnaire, which was adjusted to represent the effectiveness of the cognitive evaluation of elite gymnasts under competitive pressure.

The primary data collection procedure was carried out directly at the GOR Arcamanik training center through field observations and questionnaire administration. These data collection steps followed standard sports research procedures to ensure the authenticity of the subjects' responses (Maksum, 2012). During the completion process, the researcher directly assisted the subjects to provide uniform instructions. The physical presence of the researcher was crucial to ensure that every athlete had the same understanding of each question item, thereby effectively minimizing the risk of instrument interpretation bias.

The collected data were then processed using IBM SPSS statistical software. The first stage of analysis involved descriptive statistics to map the frequency distribution and the central tendency of the data. By using the mean (M) and standard deviation (SD) values, the athletes' scores were classified into three main categories. This categorization process referred to psychological classification norms that allow for the accurate identification of a subject's position within their group (Azwar, 2017). To provide meaning to these descriptive scores, the norm classification is presented in **Table 1.**

Table 1. Score classification with mean and standard devitiation

Interval	Category
X > (M + 1 SD)	High
(M - 1 SD) ≤ X ≤ (M + 1 SD)	Medium
X < (M - 1 SD)	Low

Subsequently, a normality prerequisite test was conducted using the Shapiro-Wilk method. This method was specifically chosen because it has the highest level of accuracy for testing normality in small sample sizes, specifically below 50 respondents (Ghasemi et al., 2012). Because the identification results showed that the data distribution was partially non-normal, the data analysis strategy was shifted from parametric statistics to a non-parametric statistical approach. This step was taken so that the test results remained objective and possessed strong statistical validity (Field, A. 2018)

The final stage of the research was hypothesis testing using the Kendall's Tau-b correlation test to determine the significance level of the effect between variables. The selection of this test was based on its ability to handle ordinal scale data and non-normal distributions in small samples. The hypothesis data processing was executed computationally by referring to the non-parametric statistical algorithm equation (Field, A. 2018). as follows::

$$\eta=(Nc-Nd)/\sqrt{((N^0-N^1)(N^0-N^2))}$$

Description:
η = Kendall's Tau-b correlation coefficient
Nc = Number of concordant pairs
Nd = Number of discordant pairs
N_0 = Total pair probability n(n-1)/2
N_1,N_2 = Correction factor for tied ranks in X and Y variables.

RESULTS AND DISCUSSION

Based on the descriptive statistical analysis conducted on 11 elite gymnastics athletes from PPLP West Java, a distribution frequency mapping was obtained for the mental toughness and decision-making variables. This mapping is presented in **Table 2.**

Table 2. Frequency Distribution of Mental Toughness and Decision Making

Category	Mental Toughness	Percentage	Decision Making
High	1	9.1%	2
Medium	10	90.9%	9
Low	0	0%	0
Total	11	100%	11

The data in **Table 2** indicates a highly homogeneous psychological and cognitive profile among the athletes. A significant majority (90.9%) of the athletes possess mental toughness in the medium category, and 81.8% demonstrate decision-making abilities also within the medium category. This phenomenon suggests that elite-level student-athletes have established a stable baseline for toughness and situational evaluation, yet they still require further specialized mental and cognitive training to reach the maximum threshold.

To test the hypothesis regarding the influence between the two variables, a non-parametric correlation analysis was performed using the Kendall's Tau-b test. The results of the statistical calculations are summarized in the following matrix format in **Table 3.**

As shown in **Table 3**, the correlation coefficient is -0.200 with a significance value (p-value)

of 0.420. Since the significance value is considerably higher than the standard alpha level of 0.05 (0.420 > 0.05), the research hypothesis is rejected. This indicates that there is no significant influence of mental toughness on the decision-making of the elite gymnasts studied. Furthermore, the low negative coefficient suggests a very weak and non-linear relationship, implying that changes in mental toughness levels do not directly dictate the sharpness of an athlete's decision-making in the field..

Table 3. Results of Kendall's Tau-b Correlation Analysis

Variabel	Correlation Coefficient	Sig. (2-tailed)	N
Mental Toughness → Deci-sion Mak-ing	-0,200	0,420	11

These findings provide an important theoretical contribution to the study of closed-skill sports. In gymnastics, the competitive environment is static, and every movement sequence is precisely pre-planned. This study aligns with the arguments of (Zheng, 2024), who state that in closed-skill sports, decision-making is largely governed by automatized motor schemes. An athlete's response to a technical error on an apparatus is primarily a product of muscle memory developed through repetitive training, rather than a result of conscious cognitive evaluation influenced by situational mental fluctuations.

The highly structured nature of gymnastics differs significantly from open-skill sports, where adapting to dynamic opponent tactics requires stronger support from mental toughness variables (Cowden, 2017). Therefore, decision-making in this specific athletic field is an ecological dynamic influenced heavily by the environment and the athlete's expertise level (Araújo et al., 2006). At the expert level, making a critical movement decision relies on instant pattern recognition rather than a lengthy cognitive search for options (Raab & Johnson, 2007). For the gymnasts at PPLP West Java, pure technical maturity appears to be a more dominant determinant in the quality of movement decisions. Consistent with the views of Wang et al. (2024), in athletic situations requiring high levels of automation, the link between psychological variables and cognition often diminishes because the effectiveness of actions has been taken over by kinesthetic instincts developed through long-term practice at the Arcamanik Gymnasium. Gymnastics is a self-paced sport where athletes have full control over the initiation of their movement sequences without unpredictable interference from opponents (Zhu et al., 2024). The results of this study support the arguments of Zheng et al. (2024), which state that in closed-skill sports, the cognitive process of decision-making relies more heavily on automatized motor schemes and prolonged technical repetition rather than independent fluctuations in psychological variables.

Despite these findings, this research has several limitations. The primary limitation is the small sample size restricted to a single regional training center, which limits the broader generalizability of the results. Additionally, measuring cognitive processes solely through self-reported questionnaires may not fully capture the complex dynamics of split-second decision-making. For future research, it is suggested to expand the sample size to a national level and incorporate qualitative observational methods. Practically, coaches are suggested to prioritize technical repetition drills under simulated competitive pressure to directly improve the decision-making quality of elite gymnasts, rather than solely focusing on general mental training.

CONCLUSION

Based on the findings of this study, it can be concluded that there is no substantial influence of mental toughness on the decision-making abilities of elite gymnastics athletes at PPLP West Java. The psychological and cognitive profiles of the gymnasts are predominantly at a medium level, indicating a stable baseline of toughness that has not yet reached its maximum potential. The absence of this correlation highlights the specific characteristics of gymnastics as a closed-skill sport. At the elite coaching level, the effectiveness of an athlete's movement decisions during competition is not dictated by fluctuations in situational mental states, but rather relies heavily on automatized movement schemes and muscle memory developed through long-term technical training.

The implications of these findings emphasize the importance of adjusting coaching strategies. While fostering mental toughness remains necessary to maintain the athletes' general focus, training programs for elite gymnasts must prioritize pure technical repetition under simulated competitive pressure. Coaches are highly recommended to continuously increase the proportion of movement automation so that athletes' kinesthetic instincts can rapidly and accurately take over the decision-making function, especially when split-second technical errors occur on the apparatus.

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