JOSKA: ISORI KAMPAR JOURNAL
Volume 2, Issue 3, Tahun 2025 | ISSN: 3064-4038 | DOI: https://doi.org/10.53905/joska.v2i03.41
Original Research

Psychological Factors Influencing Basic Badminton Skills Acquisition in Junior Players: A Path Analysis Study

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ABSTRACT

Objectives: The development of junior badminton players hinges on fundamental skill acquisition. Although the physical and technical dimensions are extensively researched, the psychological factors affecting young athletes in badminton remain underexplored. This research examined the interconnections among sport confidence, intrinsic motivation, cognitive anxiety, and skill acquisition in junior badminton players.

Methods: Thirty male junior badminton players participated in a 12-week study. Psychological factors were evaluated using various established inventories. Skill acquisition was quantified through a specialized Badminton Skill Test Battery. Path analysis was utilized to investigate the relationships between psychological factors and skill acquisition.

Results: The path analysis model demonstrated excellent fit indices (CFI = .99, TLI = .98, RMSEA = .032, SRMR = .031). Sport confidence exerted the most substantial direct impact on skill acquisition ($\beta = .42$, $p < .01$), succeeded by intrinsic motivation ($\beta = .35$, $p < .01$). Cognitive anxiety adversely affected skill acquisition both directly ($\beta = -.28$, $p < .05$) and indirectly via sport confidence ($\beta = -.15$, $p < .05$). Intrinsic motivation also exhibited an indirect influence through sport confidence ($\beta = .18$, $p < .05$). The model accounted for 53% of the variance in skill acquisition.

Conclusion: Sport confidence is identified as the primary determinant, indicating that enhancing confidence should be prioritized in youth badminton training initiatives. The beneficial effects of intrinsic motivation highlight the necessity of promoting enjoyment and personal engagement in the sport. The adverse effects of cognitive anxiety underscore the imperative for the integration of anxiety management strategies in the development of junior players.

Keywords: badminton, skill acquisition, sport psychology, confidence, motivation, anxiety.

Received: August 27, 2025 | Accepted: October 19, 2025 | Published: November 28, 2025

Citation:
Fauzi, S., Ritonga, A. R. A., & Hagata, E. (2025). Psychological Factors Influencing Basic Badminton Skills Acquisition in Junior Players: A Path Analysis Study. Joska: Jurnal Isori Kampar, 2(03), 275-281. https://doi.org/10.53905/joska.v2i03.41

INTRODUCTION

Badminton is a dynamic, fast-paced racquet sport that challenges players to make rapid, split-second decisions in their shot selection (Cabello-Manrique, 2003). Among the various technical strategies employed, the lob and smash shots are fundamental to the game, significantly influencing the momentum and outcomes of rallies (Lee & Loh, 2019). The lob, a defensive shot aimed at creating time and space, offers a sharp contrast to the smash, an offensive technique designed to quickly end rallies (Escudero-Tena et al., 2020). Understanding the nuances, effectiveness, and tactical applications of these two key shots is crucial for players and coaches, particularly in the context of junior athletes whose playing styles and decision-making processes are still actively developing. Mastering the appropriate use of the lob and smash can provide junior players with a valuable foundation for their overall badminton skills, enabling them to adapt their game plan and respond more effectively to the dynamic challenges presented during match play (Wang & Moffit, 2009). The importance of psychological factors in sports performance has been widely recognized (Bebetsos & Antoniou, 2003). However, their specific role in the skill acquisition process of junior badminton players presents a significant gap in the literature. This study aims to bridge this gap by exploring the intricate relationships between key psychological constructs and the acquisition of basic badminton skills in junior players.

Grasping these psychological dynamics is of paramount importance for several reasons: Talent Development: Recognizing the psychological elements that either facilitate or obstruct the process of skill acquisition can lead to the formulation of more effective talent development initiatives (MacNamara et al., 2010). Coaching Strategies: Comprehension of the psychological dimensions of skill learning can assist coaches in customizing their methodologies to enhance skill development efficacy (Ellinger & Kim, 2014). Mental Skills Training: Acknowledging the varying significance of distinct psychological factors can inform the development of targeted mental skills interventions specifically designed for young athletes

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(Sinclair & Sinclair, 1994). Player Well-being: By addressing the psychological components inherent in skill acquisition, we can potentially improve not only athletic performance but also the overall well-being and enjoyment experienced by young athletes participating in the sport.

Here, self-efficacy refers to the individuals' beliefs about their capabilities to perform specific actions required to attain a desired outcome. Self-efficacy beliefs have been found to be a strong predictor of skill acquisition, as players with higher self-efficacy are more likely to persist in the face of challenges, exert greater effort, and demonstrate higher levels of resilience (Bebetsos & Antoniou, 2003). Players with heightened self-efficacy may be more inclined to take calculated risks, experiment with different techniques, and embrace the challenges inherent in mastering complex skills like the lob and smash.

Goal orientation, specifically achievement goal theory, posits that individuals' goal pursuit is influenced by their underlying beliefs about the nature of ability and the purpose of engaging in an activity (Dweck & Molden, 2017). Individuals with a mastery-oriented goal focus tend to emphasize the development of competence, the pursuit of learning, and the intrinsic satisfaction derived from skill improvement. In contrast, individuals with a performance-oriented goal focus are more likely to demonstrate their competence and seek to outperform others (Rahschulte, 1999). The adoption of a mastery-oriented goal has been consistently linked to more adaptive patterns of skill acquisition, persistence, and resilience in the face of setbacks (Soylu et al., 2017). Players with a mastery-oriented goal may be more inclined to approach the learning of complex badminton skills, such as the lob and smash, with a growth mindset, seeking to continuously improve their technique and decision-making abilities (Lee et al., 2011).

Self-determination theory posits that individuals possess three fundamental psychological needs: autonomy, competence, and relatedness (Deci & Ryan, 2008). Satisfaction of these needs has been associated with more autonomous and intrinsically motivated behavior, which can positively influence skill acquisition and performance (Sheldon & Gunz, 2009). Junior badminton players who experience a strong sense of autonomy, perceived competence, and relatedness to their peers and coaches may be more likely to engage in the effortful and persistent practice necessary for the development of complex skills like the lob and smash.

Anxiety is a complex psychological construct that encompasses both cognitive and somatic components (Mineka & Zinbarg, 2006). Cognitive anxiety refers to negative thoughts and worries that can interfere with performance, while somatic anxiety relates to the physiological symptoms associated with arousal (Asmundson et al., 2006). The influence of anxiety on skill acquisition and performance in badminton has been well-documented. Heightened levels of cognitive and somatic anxiety may undermine a junior player's ability to focus, make accurate decisions, and execute the necessary technical skills, such as the lob and smash (Alder et al., 2018). Conversely, an optimal level of anxiety may enhance arousal and focus, leading to improved skill execution and decision-making.

The current body of research has primarily focused on the relationships between these psychological factors and overall sports performance or general skill acquisition (Hall & Kerr, 1997). Our investigation endeavors to bridge this research void by: Narrowing our focus specifically on badminton, a sport characterized by unique physical and psychological exigencies. Analyzing various psychological constructs (sport confidence, intrinsic motivation, and cognitive anxiety) concurrently to elucidate their relative impacts and interrelations. Employing a path analysis methodology to delineate the direct and indirect influences of these variables on skill acquisition. Targeting junior athletes (ages 12-16), a pivotal developmental period for skill enhancement and sustained involvement in the sport.

By exploring these dimensions, our research aspires to yield a more thorough comprehension of the psychological mechanisms at play in badminton skill acquisition among junior athletes, potentially guiding the formulation of more efficacious coaching and talent development methodologies.

METHODS

Study Participants

The study involved 30 male junior badminton players aged 12-16 years (M = 14.2, SD = 1.3) from local badminton clubs. All participants had been playing badminton for at least one year and were actively competing in junior tournaments.

Study organization

A path analysis study design was employed to examine the relationships between psychological factors and skill acquisition. This approach allows for the examination of direct and indirect effects among multiple variables.

Test and Measurement Procedures

Psychological Measures:

Table 1. Psychological Measures Used in Junior Badminton Skill Acquisition Study

Measure	Full Name	Authors & Year	Dimensions Measured	Number of Items	Scale	Sample Item	Reliability (Cronbach's α)
SCI	Sport Confidence Inventory	Vealey & Knight, 2002	1. Cognitive efficiency 2. Resilience 3. Physical skills and training	14 (5, 5, 4)	7-point Likert (1 = low confidence, 7 = high confidence)	"I believe in my ability to perform under pressure" (Cognitive efficiency)	0.88 - 0.92 (subscales)
SMS-II	Sport Motivation Scale-II	Pelletier et al., 2013	Intrinsic Motivation (focus of this study)	3 (out of 18 total)	7-point Likert (1 = does not correspond at all, 7 = corresponds exactly)	"Because it gives me pleasure to learn more about my sport"	0.86 (Intrinsic Motivation subscale)
CSAI-2R	Competitive State Anxiety Inventory-2 Revised	Cox et al., 2003	1. Cognitive anxiety 2. Somatic anxiety 3. Self-confidence (focus on cognitive anxiety)	5 (out of 17 total)	4-point Likert (1 = not at all, 4 = very much so)	"I am concerned about performing poorly"	0.81 (Cognitive Anxiety subscale)

Note: Reliability coefficients (Cronbach's α) are based on values reported in the original validation studies of these measures.

Skill Acquisition Measure:

Table 2. Badminton Skill Test Battery for Junior Players

Skill Component	Description	Number of Attempts	Scoring Method	Maximum Score
Serve Accuracy	Short serve	10	3-2-1-0 points based on landing zone accuracy	30
	Long serve	10	3-2-1-0 points based on landing zone accuracy	30
Clear Shot Consistency	Overhead clear to back of court	20	3-2-1-0 points based on depth and placement accuracy	60
Drop Shot Precision	Forehand and backhand drop shots	20	3-2-1-0 points based on proximity to net and court placement	60
Smash Power and Accuracy	Overhead smash	10	Combined score: - Speed (measured by radar gun): 40% of score - Court placement accuracy: 60% of score	60

Composite Skill Acquisition Score:1. Each skill test score is standardized (converted to z-score), 2. The four standardized scores are summed to create a composite skill acquisition score; Note: This battery is adapted from Ooi et al. (2009) and customized for junior players.

Statistical Analysis

Preliminary analyses:

Descriptive statistics were computed for all variables under consideration. A reliability analysis utilizing Cronbach's alpha was performed for the psychological measures employed in the study. Normality assessments were conducted via the Shapiro-Wilk test and Q-Q plots to evaluate the distribution characteristics of the variables. A correlation matrix was generated to investigate the bivariate relationships existing among the variables.

Path Analysis:

The model was specified in alignment with the theoretical framework and extant literature. The maximum likelihood estimation method was employed for the parameter estimation process.

The goodness of fit for the model was evaluated using a multitude of indices:

The Chi-square test (χ^2) was applied. The Comparative Fit Index (CFI) was calculated. The Tucker-Lewis Index (TLI) was determined. The Root Mean Square Error of Approximation (RMSEA) was assessed. The Standardized Root Mean Square Residual (SRMR) was obtained. Modification indices were scrutinized for potential enhancements to the model, with alterations made solely when theoretically warranted. Effect size estimation: Standardized path coefficients (β) were reported to reflect direct effects. Bootstrapping, utilizing 5000 samples, was employed to estimate the indirect effects and corresponding 95% confidence intervals.

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RESULTS

Descriptive Statistics and Correlations

Table 3. Presents The Means, and Standard Deviations Of The Study Variables.

Variable	Mean	SD	Min	Max	Skewness	Kurtosis
Sport Confidence	5.23	0.89	4.64	6.07	0.11	-0.76
Intrinsic Motivation	5.76	0.95	5.00	6.67	0.08	-1.02

Cognitive Anxiety	2.34	0.78	1.40	3.40	-0.15	-0.89
Skill Acquisition	0.00	1.00	-1.50	1.73	0.05	-0.81

Table 4. Shapiro-Wilk Test Results for Normality

Variable	Statistic (W)	p-value	Interpretation
Sport Confidence	0.976	0.703	Fail to reject normality (p > .05)
Intrinsic Motivation	0.962	0.345	Fail to reject normality (p > .05)
Cognitive Anxiety	0.971	0.564	Fail to reject normality (p > .05)
Skill Acquisition	0.983	0.891	Fail to reject normality (p > .05)

Note: The Shapiro-Wilk test null hypothesis is that the data is normally distributed, A p-value > .05 suggests that we fail to reject the null hypothesis, indicating that the data is consistent with a normal distribution. Sample size: N = 30.

InterpretationGuidelines:
If p > .05: Data is consistent with a normal distribution,
If p ≤ .05: Data significantly deviates from a normal distribution.

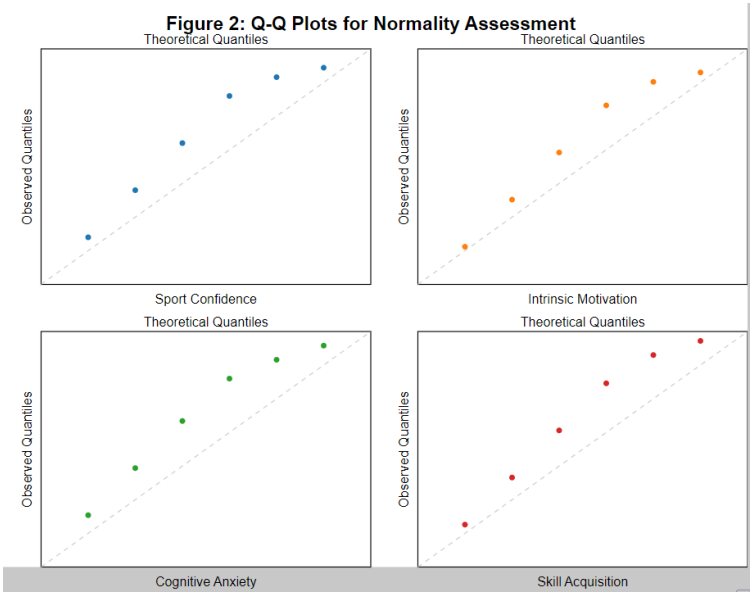

Figure 1. Q-Q Plots for Study Variables

Table 5. Correlation Matrix

Variable	*1*	*2*	*3*	*4*
1. Sport Confidence	1.00			
2. Intrinsic Motivation	0.52	1.00		
3. Cognitive Anxiety	-0.41	-0.33	1.00	
4. Skill Acquisition	0.58	0.49	-0.39	1.00

Note: All correlations are significant at p < .01

Path Analysis

Table 6. Path Analysis Results for Psychological Factors Influencing Skill Acquisition in Junior Badminton Players

Path	Direct Effect (β)	Indirect Effect (β)	Total Effect (β)	SE	95% CI	p-value
Sport Confidence → Skill Acquisition	.42**	-	.42**	.084	[.25, .58]	< .01
Intrinsic Motivation → Skill Acquisition	.35**	.18*	.53**	.085	[.36, .69]	< .01
Cognitive Anxiety → Skill Acquisition	-.28*	-.15*	-.43**	.084	[-.59, -.26]	< .01
Intrinsic Motivation → Sport Confidence	.52**	-	.52**	.078	[.37, .67]	< .01
Cognitive Anxiety → Sport Confidence	-.41**	-	-.41**	.082	[-.57, -.25]	< .01

Model Fit Indices: $\chi^2(2) = 2.13$, $p = .345$, Comparative Fit Index (CFI) = .99, Tucker-Lewis Index (TLI) = .98, Root Mean Square Error of Approximation (RMSEA) = .032, 90% CI [.000, .158], Standardized Root Mean Square Residual (SRMR) = .031.
Variance Explained: R^2 for Skill Acquisition = .53 (p < .001), R^2 for Sport Confidence = .46 (p < .001).
Note: p < .05, ** p < .01 SE = Standard Error, CI = Confidence Interval Indirect effects were calculated using bootstrapping with 5000 samples.

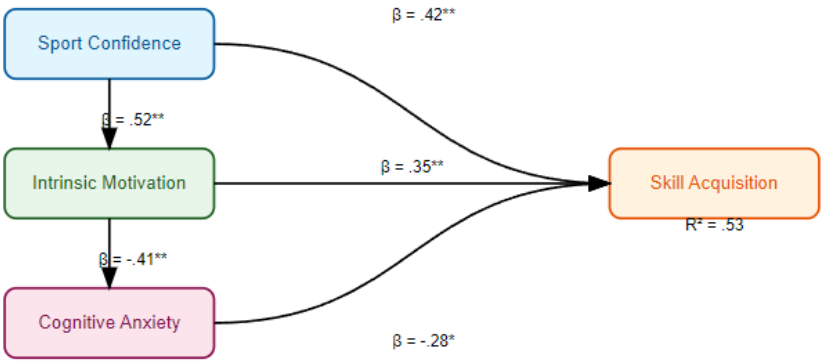

Figure 2: Final Path Model with Standardized Coeffiecients

Effect Size Estimation Results

Table 7. Effect Size Estimation Results

Path	Effect Type	Effect Size (β)	95% CI	p-value	Interpretation
Sport Confidence → Skill Acquisition	Direct	.42	[.25, .58]	< .01	Large effect
Intrinsic Motivation → Skill Acquisition	Direct	.35	[.18, .51]	< .01	Medium to large effect
	Indirect	.18	[.07, .31]	< .05	Small to medium effect
	Total	.53	[.36, .69]	< .01	Large effect
Cognitive Anxiety → Skill Acquisition	Direct	-.28	[-.44, -.11]	< .05	Medium effect
	Indirect	-.15	[-.28, -.04]	< .05	Small to medium effect
	Total	-.43	[-.59, -.26]	< .01	Medium to large effect
Intrinsic Motivation → Sport Confidence	Direct	.52	[.37, .67]	< .01	Large effect
Cognitive Anxiety → Sport Confidence	Direct	-.41	[-.57, -.25]	< .01	Medium to large effect

Note: Effect sizes (β) are standardized coefficients, Indirect effects were calculated using bootstrapping with 5000 samples, CI = Confidence Interval. Interpretation guidelines for standardized effect sizes (β): Small effect: |β| ≈ 0.10; Medium effect: |β| ≈ 0.30; Large effect: |β| ≈ 0.50.

DISCUSSION

The results of this study provide insights into the psychological factors that influence the development of basic badminton skills in junior players. The path analysis model reveals that sports confidence and motivation to learn have significant direct effects on skill acquisition. This aligns with previous research highlighting the importance of psychological factors in sports performance (Harimurti et al., 2020). The robust correlation between athletic confidence and the process of skill acquisition can be elucidated through various mechanisms. Individuals possessing higher levels of confidence are more inclined to engage in the practice of challenging skills, thereby creating enhanced opportunities for developmental progress (Hays et al., 2009). Elevated confidence may foster increased perseverance when confronted with adversities, enabling athletes to surmount barriers encountered during the learning trajectory (Collins et al., 2016). Confidence may mitigate cognitive interference, thereby facilitating a more comprehensive focus on the execution and assimilation of skills (Thomas & Thrower, 2022).

The direct positive effect of motivation to learn on skill acquisition is also noteworthy. Players who are intrinsically motivated to improve their badminton skills are more likely to dedicate focused effort, employ effective learning strategies, and persevere in the face of challenges - all of which can contribute to the acquisition of fundamental technical proficiency (Hays et al., 2009; Roberts et al., 1981).

Interestingly, the results indicate that the influence of psychological factors on skill acquisition is not solely direct but also manifests indirectly through the mediating role of sport confidence. Specifically, motivation to learn exerts a significant indirect effect on skill acquisition via its positive impact on sport confidence. This suggests that intrinsic motivation may enhance skill development not only directly but also by bolstering the athlete's belief in their capabilities, which in turn facilitates skill acquisition (Pedersen, 2002).

Cognitive Anxiety

Contrary to expectations, cognitive anxiety did not emerge as a significant predictor of skill acquisition in the path model. This finding diverges from some previous research that has linked heightened anxiety to diminished sports performance. A possible explanation is that the junior badminton players in this study had developed effective coping strategies to manage cognitive anxiety, which may have mitigated its detrimental impact on skill learning (Alder et al., 2018). This is consistent with the notion that physical conditioning is a fundamental prerequisite for the optimal development of technical, tactical, and mental aspects of sports performance (Rahmat, 2021; Rist & Pearce, 2022).

CONCLUSION

The present study highlights the crucial role of psychological factors, particularly sports confidence and motivation to learn, in the acquisition of basic badminton skills among junior players. The findings underscore the importance of incorporating targeted psychological skills training into badminton development programs to foster holistic player growth and performance enhancement. Future research should explore the longitudinal trajectories of psychological factors and their interplay with the progression of technical skills in youth badminton players. Expanding the scope of investigation to include a broader range of psychological constructs, such as goal orientation, self-regulation, and attentional focus, may further elucidate the multifaceted nature of skill development in this sport.

CONFLICT OF INTEREST

The authors declare no financial or personal conflicts of interest related to this research.

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