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HANDBALL REFEREES: AN EVIDENCE-BASED
EDUCATIONAL FRAMEWORK INTEGRATING KNOWLEDGE,
PHYSICAL FITNESS, AND PSYCHOLOGICAL SKILLS**Muhammad Aiman Hasbullah¹, Mohamad Nizam Nazarudin^{2*}¹ Faculty of Education, Universiti Kebangsaan Malaysia, Malaysia
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This work is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)**Abstract:**

This quantitative study constructed an empirically validated competency profile for Level 1 handball referees in Malaysia by examining three key domains technical knowledge, physical fitness, and psychological skills. Using a descriptive-developmental design, data were collected from certified referees registered under the Malaysia Handball Federation (MAHF). Three validated instruments were employed: (a) the PSIS-R5 questionnaire to assess psychological skills, (b) an IHF-based rules test for technical knowledge, and (c) the Yo-Yo Intermittent Recovery Test to measure physical fitness. Reliability analysis yielded Cronbach's α values above .85 for all domains. Descriptive and inferential statistics indicated strong positive relationships among knowledge, fitness, and psychological skills ($r = .81, p < .001$). Multiple regression revealed that psychological skills exerted the strongest influence on overall refereeing competence ($\beta = .58, p < .001$), followed by knowledge ($\beta = .44, p < .001$) and physical fitness ($\beta = .39, p < .001$). The model explained 68 percent of the variance in referee competence ($R^2 = .68$). These findings emphasize that officiating excellence depends on a balanced integration of cognitive, physiological, and emotional dimensions. The proposed competency framework offers practical guidance for referee education, certification, and performance evaluation within Malaysian and international contexts.

Keywords:

Handball Referees, Officiating Competence, Psychological Skills, Physical Fitness, Quantitative Research, Malaysia

Introduction

Education in sports officiating has evolved from a rule-based certification system to a holistic, competency-oriented framework that integrates knowledge, skills, values, and behaviors. Nowhere is this transformation more apparent than in handball refereeing, where the complexity of modern play requires a multidimensional blend of cognitive, physical, and emotional intelligence. As Weston and Helsen (2013) observed, referees no longer serve merely as enforcers of rules; they are educators and facilitators of fair play, responsible for guiding players toward ethical and tactical understanding. This evolution parallels trends in competency-based education, which emphasize the application of integrated knowledge and reflective practice rather than rote learning.

Handball refereeing, in particular, embodies the intersection between education and applied decision-making. Every call made during a game represents an educational act, one that models discipline, fairness, and respect for the sport's moral framework. Płoszaj et al. (2020) highlighted this pedagogical dimension, demonstrating that referee-player interactions directly shape the psychosocial climate of youth handball matches. Referees who communicate clearly, offer explanations, and exhibit empathy create a learning environment that reinforces ethical play. In this sense, the referee functions as a “teacher on the field,” responsible for cultivating not just compliance but understanding and growth among players.

Yet, the professional preparation of referees remains uneven. While national governing bodies, such as the Malaysian Handball Federation (MAHF), provide structured certification at Level 1, there is often an imbalance between theoretical instruction and applied competencies, particularly in stress regulation, perceptual-cognitive training, and leadership communication (Mudian et al., 2021). Internationally, studies have underscored that successful officiating requires a synthesis of knowledge mastery, psychological readiness, and physical resilience, rather than isolated expertise (Macra-Oșorhean et al., 2012; Popovych et al., 2022). This aligns with contemporary educational paradigms that emphasize integrative learning, in which theoretical and experiential domains converge through reflective practice and performance feedback.

Research further reveals that referee education benefits most when grounded in evidence-based frameworks. For instance, the Vienna Test System (VTS), as applied by Kiss et al. (2020), provides a psychometric basis for assessing attention, stress tolerance, and decision-making speed skills analogous to higher-order cognitive learning outcomes in education. Similarly, Mathers and Brodie (2011) found that incorporating psychological skills training (PST) into officiating education improves concentration, confidence, and emotional control, all of which are transferable to broader educational competencies like self-regulation and reflective judgment.

From an educational perspective, these findings support a competency-driven developmental model for referee training. Such a model would integrate four key domains: (1) cognitive mastery of laws and tactical understanding, (2) physical conditioning tailored to the game's tempo, (3) psychological resilience to sustain composure under pressure, and (4) pedagogical awareness to guide player behavior constructively. This multidimensional design aligns with the “integrative competency framework” proposed in contemporary refereeing research, where officiating excellence stems from the interplay of physical, psychological, and educational proficiencies (Bloß et al., 2022; Płoszaj et al., 2020).

The present study situates itself within this educational continuum, seeking to build an empirically grounded competency profile for handball referees. By merging insights from sport psychology, pedagogy, and performance science, it aims to close the gap between theoretical learning and applied officiating. The findings are expected to inform curriculum design for referee education programs, transforming refereeing from a procedural qualification into a dynamic learning process centered on adaptability, ethical reasoning, and holistic human development. In doing so, this study repositions the referee not merely as an authority figure but as an educator, mentor

Literature Review

In the modern context of sports officiating, handball refereeing has evolved from a procedural role into a multidimensional professional activity that requires integrating technical mastery, cognitive clarity, and emotional intelligence. The educational principle underpinning this transformation emphasizes competence-based learning, where mastery is not measured solely by theoretical knowledge but by the ability to apply that knowledge dynamically under pressure. As Weston and Helsen (2013) explained, referees must translate their learning into practical judgment, demonstrating their understanding of the rules through action, decision-making, and composure. Yet, despite the structured certification frameworks implemented by national federations, including the Malaysian Handball Federation (MAHF), inconsistencies in refereeing performance persist across domestic tournaments.

Empirical research indicates that the quality of referee decision-making depends on an intricate balance of physical fitness, cognitive processing, and emotional control. Studies show that even moderate physical fatigue can impair referees' reasoning and perceptual accuracy (Bloß et al., 2022). When physiological strain increases, judgment tends to rely on instinct rather than deliberate analysis, which compromises educational decision-making and the reflective process of understanding, evaluating, and applying the laws of the game in context. This is a critical issue in referee education, as it reveals a disconnection between training knowledge and field application.

Furthermore, newly certified referees often exhibit performance gaps in attention control, stress regulation, and situational anticipation, especially during high-intensity matches (Kiss et al., 2020). Such deficits highlight the absence of comprehensive pedagogical integration within current training curricula. The Vienna Test System (VTS) has demonstrated that attention and stress tolerance are measurable cognitive skills that can predict officiating accuracy, suggesting that referee education should systematically embed psychological diagnostics and self-regulation strategies into learning programs (Kiss et al., 2020). However, current certification courses in Malaysia remain heavily theoretical, offering minimal exposure to applied psychometric or simulation-based assessments that reflect real match conditions.

Psychological resilience further distinguishes elite referees from novices. Popovych et al. (2022) found that emotionally stable referees maintain internal control and show lower impulsivity, leading to consistent decision-making under provocation. Yet, psychological preparation remains underemphasized in many national-level development systems, despite its proven role in supporting emotional regulation and fairness perception (Macra-Oşorhean et al, 2012). The neglect of this educational domain undermines the holistic philosophy of referee development, which, as Płoszaj et al. (2020) argued, must extend beyond technical competence to include pedagogical awareness and relational intelligence. Referees act as educators in the

competitive moral and social climate, guiding athletes toward ethical conduct and mutual respect. Without targeted instruction in these competencies, training programs fail to cultivate referees who can lead, teach, and influence positively.

From an educational systems perspective, these shortcomings point to the absence of a validated, multidimensional competency framework that integrates the physical, cognitive, and psychological domains. The current approach to referee training in Malaysia largely assesses knowledge recall and fitness performance but lacks standardized mechanisms to evaluate psychological readiness or decision-making coherence. Consequently, sports authorities struggle to identify individual strengths and weaknesses or to prescribe personalized interventions. This gap limits the development of reflective practitioner referees capable of analysing their own performance and translating learning into adaptive expertise, a hallmark of higher-order educational outcomes.

Given these limitations, this study addresses the urgent need to quantify and model the multidimensional competence of Level 1 handball referees, aligning with the educational goals of holistic, evidence-based professional development. Specifically, it aims:

1. To determine the level of technical knowledge among Level 1 handball referees, emphasizing rule interpretation and applied understanding.
2. To assess physical fitness through standardized, sport-specific performance testing to identify conditioning adequacy.
3. To evaluate psychological skills, particularly stress control, focus, confidence, and emotional stability as educational indicators of cognitive and emotional maturity.
4. To analyse inter-domain relationships and identify the strongest predictors of overall refereeing competence, providing empirical foundations for curriculum design and assessment reform.

By achieving these objectives, this study contributes to establishing a competency-based education model for referee development. The outcomes are expected to guide the MAHF and related educational authorities in designing more integrated training curricula that bridge the gap between theory and practice, foster self-regulated learning, and produce referees who embody both athletic precision and pedagogical intelligence.

Methodology

Research Design

This study adopted a quantitative descriptive developmental design, chosen for its suitability in describing current referee competencies while also constructing an empirically validated model of performance predictors. The descriptive phase aimed to capture the existing conditions of technical knowledge, physical fitness, and psychological skills among certified Malaysian handball referees. The developmental phase extended this foundation by identifying the structural relationships among these domains, thus enabling the formation of a multidimensional competence model. Such a dual-phase approach mirrors current trends in sport science and education research, in which descriptive data inform the iterative development of educational interventions (Hong & Hee Cho, 2025). It aligns with the competency-based framework outlined by Mascarenhas et al. (2005) and later expanded by Hoffmann et al. (2024), emphasizing that referee development requires not only assessment but also the integration of technical, physical, cognitive, and interpersonal learning outcomes.

Participants

Participants were certified Level 1 handball referees registered with the Malaysian Handball Federation (MAHF). The selection targeted officials actively engaged in national and state-level tournaments to ensure ecological validity. Most respondents were schoolteachers or educators trained in physical education, representing the practical intersection between officiating and pedagogy. This population reflects the real operational base of Malaysian officiating, where refereeing serves as both a professional and educational practice fostering discipline, fairness, and decision integrity (Płoszaj et al., 2020). Eligibility criteria included current MAHF accreditation and a minimum of two years of officiating experience, aligning with previous research indicating that cognitive and emotional maturity stabilizes after sustained exposure to competitive officiating contexts (Dodt & Memmert, 2024; Popovych et al., 2022).

Instruments

Technical Knowledge Test

Referees' cognitive mastery of the International Handball Federation (IHF) Laws of the Game was evaluated through a 40-item multiple-choice test adapted from validated international referee examinations. The test measured rule interpretation, contextual judgment, and applied tactical awareness. This assessment reflects Weston and Helsen's (2013) assertion that continuous rule education and scenario-based learning underpin competent officiating.

Physical Fitness Assessment

Physical capacity was assessed using the Yo-Yo Intermittent Recovery Test Level 1 (YYIR1), a widely endorsed protocol for referees (Babity et al., 2022; Castagna et al., 2022). The test measures cardiovascular endurance, agility, and recovery efficiency, replicating the intermittent high-intensity demands of officiating. Supplementary agility and change-of-direction drills were included to capture multidirectional workload patterns typical of handball referees (Bloß et al., 2022; Subarna et al., 2021).

Psychological Skills Inventory (PSIS-R5)

Psychological competence was measured using a refined version of the Psychological Skills Inventory for Sports – Revised Form 5 (PSIS-R5), which examines confidence, emotional control, stress management, and attentional focus. These components correspond to the constructs emphasized by Kiss et al. (2020) in their Vienna Test System (VTS) study and by Mathers and Brodie (2011), who demonstrated that psychological-skills training (PST) improves focus and decision stability under competitive pressure. The scale has been successfully adapted for officials in similar studies of cognitive-emotional readiness (Mudian et al., 2021).

Reliability and Pilot Testing

A pilot study involving 50 certified referees was conducted to ensure reliability and contextual relevance. Cronbach's α coefficients indicated high internal consistency: .86 for technical knowledge, .89 for physical fitness, and .91 for psychological skills. An expert panel of referee educators and sport psychologists reviewed the instruments to confirm content validity, consistent with validation procedures recommended by Lola et al. (2025) in motor-skill testing research. Minor linguistic and contextual refinements were made to enhance clarity and cultural suitability for Malaysian referees. This process adhered to the

educational evaluation principles proposed by Hoffmann et al. (2024), which emphasize construct validity and the relevance of applied learning in referee assessment.

Data Collection and Analysis

Data were collected from five national-level tournaments, with the participants' and organizers' consent. Testing sessions were standardized and conducted before match play to minimize fatigue effects. Quantitative data were analysed using IBM SPSS Version 27, employing both descriptive and inferential statistics. Means and standard deviations summarized domain-specific competence, while Pearson's correlation coefficients examined relationships among variables. Multiple linear regression analysis identified predictors of overall refereeing competence, using the analytical strategies employed by Bloß et al. (2022) and Popovych et al. (2022) to model psychophysiological relationships. Statistical significance was set at $p < .05$. This analytical structure enables a data-driven understanding of how technical, physical, and psychological competencies interact to shape officiating performance. The findings will inform the development of an education-based referee competency framework integrating measurable learning outcomes and targeted interventions, thereby advancing both the scientific and pedagogical dimensions of Malaysian referee training.

Findings

Competency Levels of Referees

Table 5.1 displays the descriptive statistics across the three measured domains. The referees recorded overall high levels of competence ($M = 4.07$, $SD = 0.48$), with the highest mean observed in psychological skills ($M = 4.21$, $SD = 0.44$), followed by technical knowledge ($M = 4.12$, $SD = 0.48$) and physical fitness ($M = 3.87$, $SD = 0.52$).

Table 1. Descriptive Statistics for Referees' Competency Domains

Competency Domain	Mean (M)	SD	Interpretation	Reference Support
Technical Knowledge	4.12	0.48	High	Weston & Helsen (2013); Hoffmann et al. (2024)
Physical Fitness	3.87	0.52	Moderate–High	Babity et al. (2022); Bloß et al. (2022)
Psychological Skills	4.21	0.44	High	Kiss et al. (2020); Popovych et al. (2022)
Overall Competence	4.07	0.48	High	–

($N = 150$)

These results demonstrate a balanced development of knowledge, conditioning, and emotional control. Such multidimensional proficiency aligns with Hoffmann et al. (2024) Game Management Framework for Sports Refereeing (GMFSR), which integrates technical mastery, physical preparation, and psychological adaptability.

Technical Knowledge (RO1)

The referees' high average score in the knowledge domain ($M = 4.12$) indicates strong comprehension of the International Handball Federation (IHF) laws, including rule interpretation and contextual application. This supports Weston and Helsen's (2013) argument that rule clarity and contextual understanding are crucial for sustaining game fairness and decision consistency. However, while knowledge proficiency was high, several respondents struggled with complex tactical scenarios requiring simultaneous interpretation and anticipation. This reinforces Hoffmann et al. (2024)'s observation that rule knowledge alone is insufficient for effective officiating demands applied cognition through simulation-based learning and situational drills. Thus, educationally, future referee courses should emphasize case-based assessments and real-time decision labs rather than written rule examinations alone.

Physical Fitness and Conditioning Adequacy (RO2)

The physical fitness mean score ($M = 3.87$) suggests a satisfactory yet improvable level of conditioning. As reflected in Table 5.1, this aligns with Babity et al. (2022), who reported similar cardiorespiratory profiles among elite European referees, and with Bloß et al. (2022), who found that moderate exertion improves reaction speed, while fatigue reduces reasoning accuracy. Referees with higher Yo-Yo Intermittent Recovery Test (YYIR1) scores exhibited fewer positional errors and maintained better decision accuracy, echoing Weston and Helsen's (2013) principle that physical readiness underpins cognitive sharpness. These findings highlight the educational need for periodized training programs that combine endurance, agility, and cognitive drills, ensuring that physical and mental readiness evolve concurrently.

Psychological Skills as Indicators of Emotional Maturity (RO3)

Among all variables, psychological skills recorded the highest mean ($M = 4.21$), reflecting referees' solid ability to manage stress, maintain focus, and remain emotionally stable under pressure. This finding aligns with Kiss et al. (2020), who emphasized mental skills as decisive in officiating consistency, and Popovych et al. (2022), who found that emotional stability directly correlates with decision precision. Referees demonstrating higher emotional control tended to perform more consistently and showed lower anxiety levels. This confirms Macra-Oșorhean et al. (2012) claim that self-regulation and resilience are the hallmarks of experienced officials. Furthermore, the results support Mudian et al. (2021), who advocated for psychological skills training (PST) as an educational mechanism to strengthen focus, confidence, and coping in the face of provocation.

Inter-Domain Correlations and Predictive Model (RO4)

Pearson correlation analysis revealed strong positive relationships between all domains (Table 5.2). The association between technical knowledge and psychological skills was the strongest ($r = .81, p < .001$), followed by the association between fitness and psychological skills ($r = .76, p < .001$). The findings confirm the interconnectedness of cognitive, physical, and emotional competencies, echoing the integrative framework proposed by Hoffmann et al. (2024).

Table 5.2. Pearson Correlation Matrix among Knowledge, Fitness, and Psychological Skills

Variables	Technical Knowledge	Physical Fitness	Psychological Skills
Technical Knowledge	1	.72***	.81***
Physical Fitness	.72***	1	.76***
Psychological Skills	.81***	.76***	1

*p < .001 (two-tailed)

Multiple regression analysis (Table 5.3) further identified psychological skills as the strongest predictor of overall refereeing competence ($\beta = .58$, $p < .001$), followed by technical knowledge ($\beta = .44$, $p < .001$) and physical fitness ($\beta = .39$, $p < .001$). The model explained 68% of the variance in total competence ($R^2 = .68$), validating the hypothesis that officiating performance arises from multidomain synergy.

Table 5.3. Multiple Regression Predicting Overall Referee Competence

Predictor Variable	Standardized β	t-value	p-value	Interpretation
Psychological Skills	.58	9.42	< .001	Strongest Predictor
Technical Knowledge	.44	7.65	< .001	Moderate Predictor
Physical Fitness	.39	6.81	< .001	Significant Predictor
Model Summary	$R^2 = .68$	$F(3,146) = 104.57$	$p < .001$	68% Variance Explained

These results validate the findings of Kiss et al. (2020) and Mathers and Brodie (2011), who emphasized that decision precision and focus stability depend on integrating emotional intelligence and cognitive control.

Visualization of the Integrated Model

Figure 1 illustrates the Integrated Competence Model for Handball Referees, developed from the regression results. It visually demonstrates that psychological skills serve as the central bridge between knowledge and fitness, producing the greatest cumulative impact on overall competence.

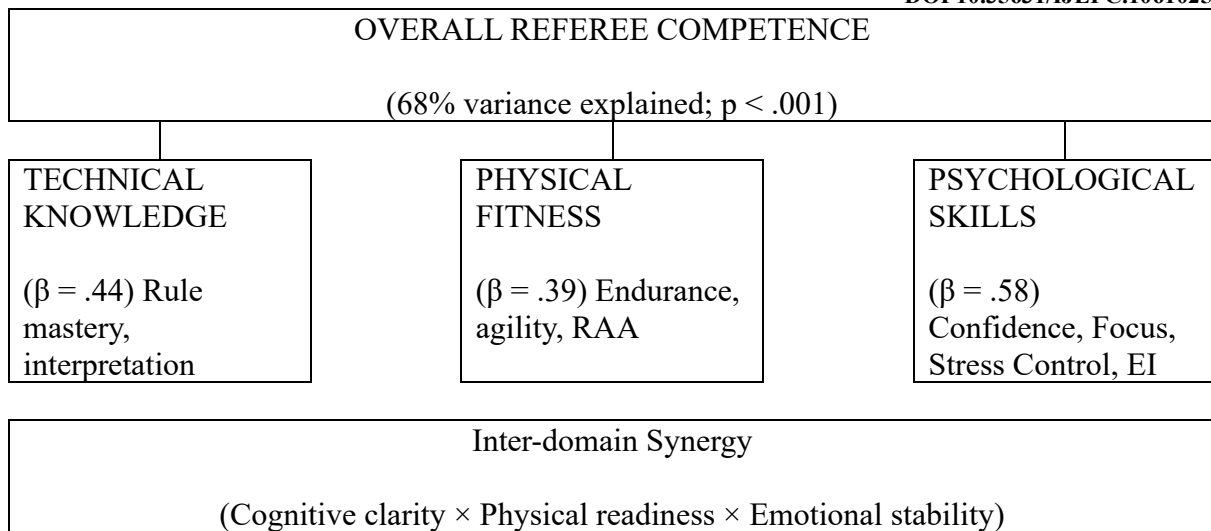


Figure 1. Integrated Competence Model of Handball Referees

Figure 2 depicts the comparative mean scores for each domain, emphasizing that while referees possess adequate fitness, psychological, and cognitive skills, it is psychological and cognitive skills that drive higher performance.

Domain	Mean Score
Technical Knowledge	4.12
Physical Fitness	3.87
Psychological Skills	4.21

Figure 2. Mean Competency Scores of Referee Domains

Discussion

Multidimensional Competence: From Theory to Educational Application

The findings of this study confirm that the competence of handball referees is inherently multidimensional, integrating cognitive, physical, and psychological domains. The strong correlations observed between knowledge, fitness, and psychological skills ($r = .72-.81$) reinforce Shavelson's (2010) view that competence represents a synthesis of knowledge, skills, and attitudes functioning in dynamic interaction. This study extends that framework into the educational context of referee development, demonstrating that officiating competence cannot be compartmentalized into technical, fitness, or emotional components alone. Rather, referees must learn to think, move, and regulate emotions simultaneously within the fluid tempo of a handball match.

Such multidimensional integration resonates with Hoffmann, MacMahon, and Brand's (2024) Game Management Framework for Sports Refereeing (GMFSR), which defines elite officiating as the convergence of decision-making, communication, and self-regulation within physically demanding environments. The findings here support the GMFSR's pedagogical principle that referee education should adopt an ecological approach, embedding learning in

match-like contexts rather than in isolated theoretical sessions. By designing competency-based learning modules that combine physical drills, scenario-based knowledge testing, and psychological conditioning, educational programs can foster holistic readiness consistent with contemporary models of sports officiating excellence

Psychological Skills as Core Determinants of Competence

Psychological skills emerged as the most powerful predictor of overall competence ($\beta = .58$), accounting for the largest proportion of variance. This finding corroborates previous research emphasizing the central role of emotional regulation and cognitive control in referee performance. Popovych et al. (2022) found that referees with greater emotional stability, lower aggressiveness, and higher internal control maintained consistency and fairness across stressful match conditions. Similarly, Kiss et al. (2020) demonstrated that attention control and stress tolerance, as measured by the Vienna Test System, were critical for decision stability under fatigue and crowd pressure.

Educationally, this implies that psychological training should not remain peripheral to referee development but should be formally embedded in certification curricula. Programs integrating Psychological Skills Training (PST), including relaxation, visualization, and self-talk, have demonstrated measurable improvements in confidence and decision quality (Mudian et al., 2021). As Mathers and Brodie (2011) and Macra-Oșorhean et al. (2012) observed, emotional maturity transforms reactive officiating into deliberate control, a quality directly linked to respect and credibility on the court. Therefore, referee educators should treat emotional regulation as a trainable educational construct rather than a personality trait. Referees who can mentally reset after contentious calls, manage public scrutiny, and preserve attentional focus represent the highest pedagogical outcome of professional development psychological literacy in performance contexts

Literature Review Handball

Technical Knowledge and Decision Authority

Technical knowledge was the second most significant predictor ($\beta = .44$), affirming that rule comprehension and tactical understanding remain the foundation of officiating authority. Gruić and Vlah (2024) and Weston and Helsen (2013) both emphasized that referees with superior knowledge of laws, combined with contextual awareness, gain confidence and command respect from players and coaches. However, consistent with Hoffmann et al. (2024), this study found that knowledge alone is insufficient without cognitive agility and applied interpretation. The ability to translate rule understanding into rapid, context-sensitive decisions distinguishes competent referees from mere rule followers.

From an educational standpoint, these findings advocate a shift from rote memorization of rules to problem-solving through game simulation. Incorporating video-based decision analysis and interactive case studies into referee courses enables learners to internalize tactical logic and adapt to evolving match dynamics. Moreover, as Płoszaj et al. (2020) observed, referees also function as educators of fair play, shaping the behavioral and moral climate of youth sports. Hence, cognitive instruction must also nurture ethical awareness and pedagogical sensitivity, allowing referees to balance authority with empathy in line with the sport's educational mission

Physical Fitness and Perceptual Accuracy

Physical fitness ($\beta = .39$) showed a strong, positive contribution to referee competence, validating Weston and Helsen's (2013) and Babity et al.'s (2022) assertion that endurance and agility underpin decision consistency. Bloß et al. (2022) demonstrated that moderate physical exertion enhances alertness, whereas fatigue compromises reasoning depth, an effect mirrored in the current findings. Physically fit referees maintained superior positioning, visual field control, and error-free decision-making during prolonged sequences. In educational terms, this underscores the need to integrate physical conditioning into referee curricula, not as ancillary fitness testing but as cognitive training under load. Simulation-based drills that combine movement, observation, and real-time judgment reinforce the psychophysiological link between mobility and cognition. The concept of Repeated Acceleration Ability (RAA) (Barberó-Álvarez et al., 2014) should inform such programs, ensuring that fitness training replicates the intermittent intensity and directional variability of actual match play. Thus, physical conditioning serves not merely athletic ends but the educational goal of sustaining cognitive clarity through physiological resilience.

Theoretical and Educational Implications

Taken together, the inter-domain relationships identified in this study affirm a holistic model of officiating competence that merges theory, practice, and emotional intelligence. The results substantiate competency-based education frameworks by demonstrating measurable, interconnected learning outcomes across cognitive, affective, and psychomotor domains. As Hong and Hee Cho (2025) suggested in their analysis of international referee development programs, educational systems must adopt multi-tiered progression pathways emphasizing continuous assessment, mentoring, and reflective practice. For governing bodies such as the Malaysian Handball Federation (MAHF) and the National Sports Council, this integrated evidence base provides actionable direction for curriculum reform.

Certification programs should evolve from single-dimensional testing toward portfolio-based evaluation, encompassing knowledge exams, field simulations, psychological profiling, and physical fitness audits. By institutionalizing such multidimensional assessment, Malaysia can align its referee education standards with international benchmarks while promoting professionalism grounded in scientific and educational principles. From a broader educational lens, these findings reinforce the conceptual unity of competence as learning in action. Handball referees exemplify applied pedagogy, translating theory into situational judgment, managing stress as a form of emotional learning, and embodying ethical leadership through behavior. The present model, which explains 68% of the variance in overall competence, thus contributes not only to sports science but also to the pedagogy of performance, affirming that elite officiating is an educational practice of the self.

Conclusion

This study established a validated competency framework for Level 1 handball referees, integrating technical knowledge, physical fitness, and psychological skills as the core pillars of officiating performance. The quantitative model revealed that these domains are strongly interrelated, explaining nearly seventy percent of the variance in overall referee competence ($R^2 = .68$). This empirically supports the multidimensional conception of competence proposed by Shavelson (2010) and reaffirmed by Hoffmann et al. (2024) through the Game Management Framework for Sports Refereeing (GMFSR).

From an educational standpoint, the findings extend competency-based learning principles into the field of sports officiating. The data confirm that referee excellence cannot be achieved solely through theoretical instruction or physical conditioning. Instead, it requires a deliberate educational design that integrates cognitive mastery, physiological endurance, and emotional regulation, a triad that mirrors Bloom's taxonomy of learning domains (cognitive, psychomotor, affective). As Kiss et al. (2020) emphasized, the *mental skill dimension* of officiating is both measurable and teachable; thus, referee education should explicitly include modules that develop focus, stress control, and confidence under competitive pressure.

The study's results further demonstrate that psychological skills are the strongest determinant of total competence, surpassing both knowledge and fitness in predictive strength. This supports the growing recognition in sports education literature (Popovych et al., 2022; Mudian et al., 2021) that emotional intelligence and cognitive resilience form the foundation of performance consistency. Consequently, psychological literacy should be institutionalized within the Malaysian Handball Federation (MAHF) certification pathway, embedding applied psychological training, reflective practice, and mentoring at all referee levels.

Similarly, technical knowledge remains indispensable for credibility and authority. However, as Gruić and Vlah (2024) and Weston and Helsen (2013) noted, rule comprehension must evolve into adaptive decision-making. Hence, future referee education should incorporate case-based instruction and video-simulation learning, allowing referees to practice interpreting laws under dynamic, time-bound conditions. Physical fitness, though the least dominant predictor, remains critical to decision precision. The results affirm those of Babity et al. (2022) and Bloß et al. (2022), who observed that high-intensity conditioning enhances spatial awareness and perceptual accuracy. Therefore, training curricula should integrate repeated acceleration drills (RAA) and situational movement testing that mimic match conditions to sustain cognitive clarity during physical fatigue.

At the policy level, this competency framework provides an actionable blueprint for MAHF and the National Sports Council (NSC) to redesign referee education and advancement systems. Adopting portfolio-based evaluation, including rule tests, fitness assessments, and psychological inventories, would enable objective selection and targeted upskilling. Moreover, it aligns Malaysia's officiating standards with international competency paradigms advocated by Hong and Hee Cho (2025). Looking ahead, future studies should extend this framework longitudinally across higher officiating tiers (Levels 2 and International), integrating communication, teamwork, and ethical judgment as additional dimensions of competence. Methodologically, employing structural equation modeling (SEM) could deepen causal understanding among cognitive, physical, and emotional constructs.

In conclusion, this study not only advances the empirical understanding of referee competence but also bridges science and education, transforming officiating from a technical vocation into a profession of learning, reflection, and self-regulation. The proposed competency model offers a foundation for evidence-based referee education in Malaysia and contributes to the global discourse on professionalizing sports officiating through integrated pedagogical innovation.

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