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Table of contents

ACADEMIC PAPERS

COMMENTARIES

Judo as a Tool for Violent Conflict Prevention

By Omar Martin Tejada Perez

Abstract: *This article explores whether judo can serve as a meaningful tool for violent conflict prevention while critically examining the conditions under which embodied combat practice may risk reinforcing aggression. Grounded in Jigoro Kano's foundational principles of seiryoku zen'yō and jita kyōei, the paper argues that judo was conceived not merely as a system of techniques but as an educational philosophy integrating body, mind and community.*

The discussion situates Kano's vision within contemporary interdisciplinary scholarship, including peace studies, psychology and neuroscience. Concepts such as active non-violence, embodied compassion, executive functions and emotional regulation are used to show how structured judo practice can foster self-control, resilience and prosocial development. Empirical findings suggest that long-term, ethically grounded martial arts training is associated with reduced aggression and enhanced emotional intelligence, indicating that judo's protective effects are developmental rather than automatic.

At the same time, the article adopts a critical lens, noting that outcomes depend on pedagogical integrity, training duration and the preservation of reflective elements. When philosophical instruction is overshadowed by competitive emphasis, regulatory safeguards may weaken. Through initiatives such as 'Judo for Peace,' the paper illustrates how disciplined confrontation on the tatami can translate into broader peace-building practices in conflict-affected communities.

Ultimately, judo is presented not as a universal remedy for violence, but as a structured, low-cost and ethically grounded instrument capable of transforming aggression into co-operative self-regulation, when implemented faithfully.

Keywords: *judo philosophy; conflict prevention; aggression and self-regulation; peace-building practice; emotional regulation; character formation*

"In this age of enlightenment, nobody would care to prepare either for national aggression or for doing violence to others. But defence, in the cause of justice and humanity must never be neglected by a nation or by an individual. " (Kano, 1932, p.39)

JUDO: THE GENTLE WAY

Jigoro Kano, a Japanese martial artist, educator, philosopher, and internationalist, was born in 1860. During his adolescence, he learned the ancient art of *jujutsu*, a martial art developed by the Samurai over centuries of combat experience. Kano, interested in improving Japan's education system through physical, ethical and moral enhancement (Stevens, 2013, p. 44), decided to adapt *jujutsu*'s formerly harsh techniques into a safer, more selective set. As a result, he delivered training sessions where the main principles of attack and defence could be fully applied without endangering participants (Goodger & Goodger, 1977; Smolders, 2021). By developing this new system, Kano created what is today known as judo, a martial art and an Olympic sport.

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Judo means the gentle (ju) way (do) as it promotes flowing movement and the efficient use of energy against pure force. It almost renders the opponent's size or weight irrelevant if its physical and mental principles are properly applied (Watanabe & Avakian, 2011). Nevertheless, judo is not only about physics; it is also about ethics, morals and intellectual development, so the mindset and character of the practitioner (*judoka*) complement the physical aspect, which sets the integral view of this martial art. For example, it has been stated that "up to half of [the] judo instruction was lectures by Kano on ethics, morality and health" (Gatling, 2021). Kano firmly believed that these principles would serve the purpose of judo in both the training room (dojo) and in the *judoka*'s daily life (Stevens, 2013). Therefore, the practice of judo, as viewed by its creator, had the following main methods (Kozdras, 2019): *randori* or free practice; *kata*, the way of seeking perfection in technique performance, a set of pre-arranged and choreographic performances (Bradić et al., 2021); *mondo*, consisted of the discussion, questions and answers between students and instructors (Murata, 2018; Stevens, 2013); while *kogi*, a broad understanding of the art that includes theoretical lectures beyond the physical aspect, was also promoted (Scott, 2019; Goodger, 1981). According to Kozdras (2019), the last two methods enable students to understand the educational aspect of judo fully.

Unlike *jujutsu*, judo's non-violent approach was understood as a way of education in an era of Japan opening up to the international community (Stevens, 2013). Judo was developed by combining Eastern Confucian and Zen concepts with Western concepts, including energism and utilitarianism (Gatling, 2021). In this regard, today's judo preserves ancient traditions of courtesy, respect and self-reflection, among other values. For instance, the act of bowing is a common practice among all who step on the mat (*tatami*) to show respect to others. Meanwhile, *mokuso* is a form of meditation practised before and after judo practice, allowing students to clear their minds and seek a moment of calm and balance, to preserve clarity and halt aggressive behaviour (Hori et al., 2002; Trusz & Balbinotti, 2026). Judo also offers other practical teaching experiences that can be applied to daily life easily, from its physical aspect. In this regard, notions such as *nana korobi ya oki* (fall down seven times, rise eight) or the principle of yielding in order to prevail, do not merely describe technical aspects of practice. Rather, they are deeply embedded in the mindset of many European *judoka* and contribute to shaping a resilient and non-violent disposition, both on and off the *tatami* (Gostović, 2020). Together with other precepts, some not exclusive to judo but nonetheless consistent with Kano's philosophy, these principles play a formative role in the development of the *judoka*'s character.

Furthermore, judo also teaches much about the human body, its physics and biomechanics. *Nage-waza* (throwing techniques) and *katame-waza* (grappling techniques on the ground) are the main groups of techniques (Judo Info, 2020). They show how concepts such as the centre of gravity, leverage, acceleration, momentum, strength, resistance, balance, centrifugal force, gravity, weight distribution, pivot point, shock absorption, vibration, and inertia, among others, impact human bodies and influence their interactions (Sacripanti, 2012; 2015). This learning process develops the individual's understanding of how physics influences judo's performance both on and off the *tatami*. On another note, the practice of *ukemi* (breakfalls), teaches a *judoka* how to fall safely when thrown and also, by applying this skills in their daily life, gives them a tool to, for instance, reduce or even avoid damage when having an accidental fall, let us say, in the bath at home or on a slippery floor (Arkkukangas et al., 2021; Toronjo & del Castillo, 2021).

In this sense, Kano's desire to use judo as a way of self-enlightenment for the individual and, at the same time, a co-operation-based activity for the benefit of all, found its way when, after all his research and the constant refining of his original art, its fundamentals were encircled in two main principles called *seiryoku zenyo* (the best use of energy) and *jita kyoei* (mutual benefit), which together form the cornerstone of judo's philosophy (Gatling, 2021; Stevens, 2013). Through these two principles, Kano not only sought to emphasise the union of mind and body and their efficient use in making all aspects of life good, and also highlight the relationship between the individual and their community and, ultimately, his role in helping to build a better society. He believed judo was a way to work towards a better world and to constantly advocate for peace (Stevens, 2013). As an educator and philosopher, Kano might have been aware that theories from different fields would support and influence his view at the time. They continue to do so today, more than a century after the development of judo.

Having examined judo as 'the gentle way' and explored its historical origins, pedagogical methods and ethical foundations, it becomes clear that Kano's creation was never intended to be a mere system of physical techniques. Rather, it was conceived as a comprehensive educational philosophy integrating body, mind and community under the guiding principles of *seiryoku zen'yō* and *jita kyōei*. However, if judo is to be considered a meaningful tool for preventing violent conflict, its philosophical aspirations must be situated within a broader analytical framework. In other words, the transition from descriptive exposition to conceptual examination is necessary. The following section, therefore, establishes the theoretical foundation that connects Kano's vision with contemporary scholarship in fields such as neuroscience, peace studies, psychology and conflict transformation. By grounding judo's ethical architecture in established theoretical perspectives, the argument moves from an historical narrative to an interdisciplinary analysis, clarifying how and under what conditions judo may contribute to the regulation of aggression and the prevention of violence.

THEORETICAL BASE

Kano's view aligns with concepts such as active non-violence (Cortright, 2008) and peace in both its negative and positive forms (Dinan, 2017). His approach lays the groundwork for exploring judo as a preventative tool for violent conflicts, a patient and silent role that nobody could deny the art has been performing worldwide.

For instance, the theory's potential benefits, such as the reduction of prejudice and fear, humanisation, and enhancing cohesion among different groups (Standish, 2021), together with Waller's stance seeking to exploit our differences in a positive way to find constructive ways of living (2016), may be potential outcomes of practising judo in conflict zones. This situation could be explained by Anatole Yenguete's speech about the positive impacts of judo lessons between different religious groups, Muslims and Christians, in Bangui, Central African Republic:

[When] "we train together on the mat, every difference disappears. Here, inside the gym, we come back to being individuals, athletes and human beings. We stand together by the love for this sport…. If at the beginning we met hostility and distrust, today there are many more people who approach us interested in our message of reconciliation. Judo has taught us courage and ethics. To defeat the crisis in which our country has sunk, both are needed." (Lemmi et al., 2020).

Moreover, Kalina's (2015, 2016, 2017; Mosler & Kalina, 2017) comparison of the theory of struggle (Agonology)

with judo principles acknowledges Kano's legacy in promoting physical, mental and social health, as well as its prophylactic potential. In addition, he highlights the efficient use of mind and body, as well as the peaceful resolution of conflicts, as solid links between the two judo principles.

Judo practice would also help develop what Clapton and Hiskey (2020) call 'embodied compassion.' Due to their transformative power, the researchers suggest that most traditional martial arts cultivate ethics and positive body-mind behaviours that may reduce aggressiveness, improve self-control, reaffirm mutual respect, strengthen self-esteem and confidence, and develop compassion, among others. In addition, they emphasise the importance of using the human body through martial arts like judo to address individual trauma and serve as an alternative psychotherapy, especially for those who struggle with verbal expression. All of these suggest that judo plays an essential role in reducing the likelihood of violent outcomes when parties face a conflict.

Another concept, this time from the field of neuroscience, is 'Executive Functions,' a set of cognitive skills key to succeeding in life. These skills, such as calmness, judgement, self-awareness, and others, can be developed through the practice of judo, as previously explained, and are essential for promoting good health and harmonious cohabitation, in other aspects of life (Harwood et al., 2017; Mattos Taveira do Amaral & Gabriel, 2021). Gabriel (2021) also highlights the importance of judo in improving resiliency, tolerance and social relations through the positive impact on a *judoka*'s character.

Furthermore, judo's focus on the mind-body connection and on improving self-esteem and general wellbeing aligns with the concept of Health Realisation (HR). In this sense, according to Kelley (2003), youth violence is not typically a psychopathological response but rather a symptom of a lack of positive mental health qualities, a wellbeing gap. Therefore, this approach would shed light on how vulnerable youths might reduce their aggressiveness through the practice of judo, a claim supported by Harwood et al. (2017).

All these current theories can be connected easily with the application of *seiryoku zenyo* and *jita kyoei* as cornerstones of judo practice and philosophy inside the *dojo* and in daily life. Therefore, it is no surprise that Kano's integral view of body and mind, self-enlightenment and the peaceful, communal, co-operative way of life he promoted at the beginning of the 20th century remain relevant and necessary in today's world. In this regard, it would be fair to say that judo's philosophy and benefits are vital to promoting a peaceful life among people, a point supported extensively throughout this writing.

While the preceding section has established a robust interdisciplinary foundation supporting judo's potential as a vehicle for non-violence, emotional regulation and prosocial development, a comprehensive analysis requires moving beyond its normative promise. Indeed, to argue that judo can function as a tool for the prevention of violent conflict, without critically examining its possible limitations, would risk theoretical imbalance. The same embodied practices that cultivate discipline and self-control may, under certain pedagogical or contextual conditions, produce different outcomes. Therefore, the discussion must now shift from affirmation to critical scrutiny. Considering aggressiveness as a key component of violent conflict (Robjant et al., 2020), the following section explores the circumstances under which judo might fail to regulate aggression or even inadvertently reinforce it, thereby introducing a developmental and contextual perspective essential for understanding judo not as inherently pacifying, but as a practice in which the effects depend on structure, duration and philosophical fidelity

Judo and the Risk of Reinforcing Aggressive Tendencies: A Critical and Developmental Perspective

While the philosophical and educational foundations of judo strongly orientate the practice towards mutual welfare and benefit (*jita kyōei*) and the efficient, ethical use of force (*seiryoku zen'yō*), it would be theoretically incomplete to assume that participation in judo activity is inherently protective against aggression. As with any embodied discipline involving physical confrontation, judo may carry the potential, under specific pedagogical, developmental, or contextual conditions, to reinforce aggressive tendencies rather than transform them (Reynes & Lorant, 2002).

In this context, empirical concerns about the relationship between martial arts training and aggression stem from studies such as Reynes and Lorant's longitudinal work. Their investigation of 8-year-old boys just introduced to martial arts revealed that children starting judo scored higher anger levels than their non-participating peers (Reynes & Lorant, 2001). According to them, after one year of traditional judo practice, *judoka* continued to present elevated aggression scores relative to controls, although these differences did not reach statistical significance (Reynes & Lorant, 2002). While these findings do not conclusively demonstrate a causal effect, they prompted important questions regarding the developmental and contextual conditions under which judo training may influence aggressive expression.

On another note, Nosanchuk and Lamarre (2002) cautioned that high dropout rates and self-selection bias may confound Reynes and Lorant's findings, particularly given that many parents enroll their children in judo activity in response to pre-existing discipline problems. They further argued that a one-year observation period may be insufficient to detect the regulatory effects typically associated with martial arts training, especially given the long-term commitment of consistent martial arts students.

These opposing arguments lead to the conclusion that the crucial issue is not whether judo can increase aggression but under what circumstances it might do so and how its internal structure can mitigate this risk.

To examine these concerns systematically, the analysis must move beyond general caution and disaggregate the mechanisms through which judo may either mitigate or exacerbate aggressive tendencies. Accordingly, the discussion unfolds across five interconnected dimensions. Firstly, it considers "developmental and contextual risk factors," recognising that individual traits, training environments and motivational climates shape how combative practices are internalised. Secondly, it explores "emotional regulation and competitive activation," acknowledging that heightened arousal within competitive settings can function either as a catalyst for self-mastery or as a trigger for reactive aggression. Thirdly, it turns to "Clinical perspectives: Violent Adolescents and Structured Martial Arts," particularly structured interventions with violent adolescents, to assess how supervision, ethical framing and therapeutic integration mediate outcomes. Fourthly, it analyses "personality development and self-control as mediating mechanisms," emphasising longitudinal maturation processes rather than short-term behavioural effects. Finally, it revisits "The protective architecture of the four traditional methods" to evaluate how judo's internal pedagogical design operates as a regulatory safeguard when fully implemented. Taken together, these dimensions provide a comprehensive developmental framework for understanding not whether judo influences aggression but how, under what conditions, and through which mechanisms its practice amplifies or mitigates aggressive behaviours.

Developmental and Contextual Risk Factors

It is worth mentioning that, while martial arts (e.g. Judo, Karate, Aikido, or Kung Fu) and combat sports (e.g. boxing, mixed martial arts, or wrestling) share a foundation in structured physical combat, technical skill development, and disciplined training, martial arts are generally understood as broader systems that incorporate ethical, philosophical, cultural, and self-cultivational dimensions, whereas combat sports are primarily oriented toward competitive performance under codified rules. Nevertheless, the distinction is not absolute, as disciplines such as Judo serve both as martial arts and as combat sports, blending educational, cultural, and competitive objectives (Clements, 2016; Fuller & Lloyd, 2020; Priest & Young, 2014; Young, 2009).

In this sense, combat sports are frequently associated with aggression in public discourse. As Bandura (1973; 1997, as cited in Moore et al., 2020) explains, repeated demonstration of techniques and selective reinforcement during practice may reduce inhibitions and contribute to the formation of aggressive cognitive scripts. From a personality-development perspective, individual traits interact with situational factors to influence aggressive behaviour (Zvi & Lavi, 2025). Therefore, environments that emphasise ego orientation, domination or victory at all costs may amplify pre-existing aggressive predispositions.

Therefore, further empirical distinctions between martial arts and combat sports further illuminate this issue. Kostorz and Sas-Nowosielski (2021) found that martial arts practitioners showed significantly lower hostility and lower general aggression indices than exclusive combat sport athletes. This finding suggests that the ethical-philosophical framework embedded in traditional martial arts is a decisive moderating factor. When the educational dimension is attenuated, the risk of instrumental aggression may increase (Kostorz & Sas-Nowosielski, 2021).

Similarly, Zvi and Lavi (2025) report that martial arts practitioners demonstrated lower levels of aggression alongside higher levels of self-control, emotional stability, agreeableness, and conscientiousness. While Stanković et al. (2022) found that long-term *judoka* demonstrated lower levels of indirect and physical aggression, alongside higher levels of honesty, humility and openness. Importantly, these effects were mediated by personality development and training duration, indicating that protective outcomes are developmental rather than immediate (Zvi & Lavi, 2025). In early stages of practice, especially among the youth, insufficient integration of ethical instruction may limit these protective effects.

Emotional Regulation and Competitive Activation

Ortiz-Franco et al. (2024) highlight that violent behaviour in educational contexts is closely associated with low emotional control. Their intervention study demonstrated that a judo-based programme reduced correlations between different types of violent behaviour and increased the mitigating role of emotional intelligence (Ortiz-Franco et al., 2024). These findings suggest that when emotional intelligence is intentionally cultivated, judo functions as a regulatory rather than an activating force of aggressiveness (Stanković et al., 2022).

This suggests that, in a competitive judo setting, without structured emotional reflection and cultivation, defeat or frustration may reinforce reactive anger. Thus, the pedagogical integration of emotional awareness before reaching the competition stage becomes essential for preventing the consolidation of aggressive responses on and off the *tatami*.

Clinical Perspectives: Violent Adolescents and Structured Martial Arts

Clinical applications further clarify this dual potential. Twemlow and Sacco (1998) argue that violent adolescents are often drawn to high-intensity activities and may resist traditional verbal psychotherapy. In their therapeutic martial arts programme, they emphasised that martial arts training must be embedded within a broader treatment framework that includes supervision, ethical instruction and community integration. They stress that without such structure, the training could risk reinforcing dominance behaviours; with it, however, it becomes a vehicle for discipline and prosocial restructuring (Twemlow & Sacco, 1998). In the same vein, Gleser and Brown (1988) conceptualised judo as a psychotherapeutic tool grounded in the principle of yielding and non-resistance, demonstrating that confrontation, when ethically structured, becomes a vehicle for behavioural transformation rather than domination.

This clinical insight aligns with the broader theoretical foundations presented in this essay. As emphasised, judo's philosophical architecture, grounded in mutual benefit and ethical cultivation, serves as a preventative tool against violent conflict when properly applied, meaning that structure and philosophical fidelity will be critical in determining the outcomes.

Personality Development and Self-Control as Mediating Mechanisms

Zvi and Lavi (2025) demonstrate that longer training periods are associated with higher levels of self-control, emotional stability, agreeableness and conscientiousness, which, in turn, are linked to reduced aggression. These findings indicate that martial arts practice exerts its protective influence through personality maturation and impulse regulation rather than through simple cathartic discharge.

This mediational pathway corresponds with educational research showing that judo interventions enhance emotional intelligence, which subsequently reduces aggressive behavioural correlations (Ortiz-Franco et al., 2024). Thus, aggression reduction appears to be mediated by executive regulation and emotional competence rather than by physical activity alone.

The Protective Architecture of the Four Methods

The traditional pedagogical system of judo itself contains internal safeguards against the escalation of aggression. As described in the theoretical foundation of this essay, *randori*, *kata*, *kogi* and *mondo* collectively integrate embodied practice with ethical instruction and reflective dialogue. Kozdras (2019) underscores that *kogi* and *mondo* enable students to internalise the educational dimension of the art. When these components remain integrated, judo channels aggression into disciplined co-operation.

In the case of *kata*, however, Reynes and Lorant (2004) observed during *dojo* sessions that this played a limited role in regular instruction, reserved primarily for black belt preparation, while training for lower ranks emphasised *randori*. This imbalance prioritised dynamic sparring (*randori*) over the slower, reflective learning processes central to Kano's educational philosophy (Bradić et al., 2021). Similarly, meditation and philosophical components were present but brief and largely ritualistic, potentially limiting the deeper internalisation of self-regulatory and ethical principles.

Unfortunately, these clinical and pedagogical observations suggest that the structural tendencies identified by Reynes and Lorant may not represent isolated cases. This raises an important theoretical concern: when judo practice becomes disproportionately centred on competitive sparring, without systematic integration of philosophical instruction and reflective components, the art's internal regulatory framework may be compromised (Twemlow & Sacco, 1998). Under such conditions, the erosion of its ethical and contemplative dimensions can weaken the very mechanisms designed to transform confrontation into disciplined self-regulation. Accordingly, aggression risk should not be attributed to judo as a pedagogical system per se, but rather to its fragmentation, specifically, the decoupling of combative practice from its philosophical and moral architecture.

The converging evidence across personality psychology, educational intervention research, and clinical practice supports a nuanced conclusion. Judo does not automatically reduce aggression, nor does it inherently increase it. Rather, it functions as a developmental amplifier from which the direction depends on structure, duration and philosophical integrity.

When ethical instruction, emotional regulation and reflective dialogue are preserved, judo cultivates self-control, emotional intelligence and prosocial personality traits (Ortiz-Franco et al., 2024; Zvi & Lavi, 2025). When these elements are absent, particularly in short-term or poorly supervised contexts, the risk of reinforcing reactive aggression and therefore conflict increases (Twemlow & Sacco, 1998; Zvi & Lavi, 2025).

Thus, consistent with Kano's original vision and the theoretical framework outlined previously, judo does not cultivate aggression, it regulates, reframes and ultimately transforms it, provided that its full pedagogical system remains intact.

The critical examination presented in this section underscores a central insight: judo's impact on aggression is neither automatic nor uniform, but contingent upon pedagogical integrity, developmental duration and the preservation of its ethical architecture. Far from weakening the broader argument, this nuanced understanding strengthens it by clarifying the conditions under which judo fulfills or departs from Kano's original vision. Having identified both the risks of fragmentation and the safeguards embedded within its traditional structure, the discussion can now move from theoretical and developmental analysis to applied realities. In this sense, the following section, therefore, shifts the focus from the internal dynamics of the *dojo* to the broader social sphere, exploring how, when faithfully implemented, judo's regulated confrontation on the *tatami* can translate into tangible peace-building practices in communities affected by violence and conflict.

From the *Tatami* to the Outside World: Pursuing Peace Through Judo

"As challenging as the prevention of genocide seems, let us not, by failing to make at least the attempt, forfeit our dangerously proud right to hope that the world will become better than it is now" (Waller, 2016, p. 365).

Waller's words remind us of the need to do whatever we can to prevent the different types of violent conflict, including genocide. In this sense, as previously suggested, it is essential to recognise that judo, although an important tool, must be integrated with other initiatives that are equally crucial for such a massive enterprise. Waller also tells us

that no action is small; any attempt is a small step toward halting violence; any action is worth it if well-organised and grounded in the right foundations. This approach becomes more relevant when the martial arts' usually low-cost implementation programmes and their high-value health and social outcomes are considered, as Harwood et al. (2017) suggested.

For instance, since 2007, the International Judo Federation (IJF) has been running the 'Judo for Peace' project, which delivers judo training programmes designed to enhance social cohesion and healing in several locations suffering the consequences of war and in other places facing the risk of violent outbreaks. According to Judo for Peace Director Nicolas Messner, the principles of judo and Jigoro Kano's message and philosophy can bring hope to people who have lost everything else. For him, our differences must be seen as strengths rather than weaknesses if we are to prevent and resolve conflict (Messner, 2022), aligning his thoughts with those of Waller (2016).

Judo for Peace works hand in hand with different local organisations, tailoring programmes to satisfy specific social challenges. For example, this organisation works with vulnerable youth living in an organised crime environment in the favelas in Rio de Janeiro; it also serves Syrian refugees escaping war on the border with Türkiye. The Judo for Peace programme has also been brought to the indigenous communities who suffer the socio-economic and psychological consequences of savage colonisation in northern Canada (Messner, 2022).

It is worth mentioning that, in the case of the programme in the favelas, Judo for Peace, in partnership with the Instituto Reacao, trained Olympic gold medallist and double world champion Rafaela Silva, who has become a role model for many children and teenagers in Brazil (Al Jazeera, 2016; Rowbottom, 2020). After winning a gold medal at the Olympic Games in Rio in 2016, she said:

"I started Judo in 2000 at the beginning of the project. My father put me in sport as an alternative, for me to stop fighting in the street. In judo, I found discipline. I started to respect others and take the sport seriously. Judo showed me the world. With the resources I earn, I guarantee my livelihood and help my family pay the bills" (Instituto Reação, n.d.).

Judoka around the globe support many other successful cases of resiliency and healing through judo. For instance, in today's regrettable war between Russia and Ukraine, many dojos around Western Europe welcome Ukrainian refugees to help them settle and receive the best possible means to make their lives easier. For instance, judo classes are combined with education and social activities. Everything is guided by the judo principles embraced by all *judoka* without discrimination and with the highest standards of respect (Skorokhodova, 2022). This approach aligns with the Transrational Peace Philosophy theory, which aims to reconcile diverse views and understandings of peace. In this context, peace work is defined as both an art and a science that seeks to reduce violence and promote social justice, while utilising social conflicts as opportunities for positive change (Lederach, 2003, as cited in Echavarría Alvarez & Koppensteiner, 2018).

CONCLUSION

This paper set out to examine whether judo can contribute meaningfully to the prevention of violent conflict and, at the same time, critically assess the risk that combat practice might reinforce aggression under certain conditions. Drawing from Kano's original philosophy, contemporary psychological and neuroscientific research, clinical applications and field-based peace initiatives, the evidence supports a nuanced yet hopeful conclusion.

Firstly, judo's philosophical foundation, anchored in *seiryoku zen'yō* (best use of energy) and *jita kyōei* (mutual benefit), provides coherent ethical architecture for transforming confrontation into disciplined co-operation. Kano did not design judo merely as a system of throws and holds, but as a pedagogical vehicle for character formation, communal responsibility and peaceful co-existence. The integration of *randori*, *kata*, *mondo* and *kogi* reflects this holistic intent: embodied struggle is inseparable from ethical reflection and dialogue. When these components remain intact, judo channels physical confrontation into self-regulation, mutual respect and emotional maturity.

Secondly, contemporary research reinforces this theoretical claim. Studies in personality development, executive functioning, emotional intelligence and embodied compassion suggest that long-term judo practice, when ethically grounded, cultivates self-control, resilience and prosocial traits while reducing aggressive tendencies. Importantly, aggression reduction appears to occur not through catharsis, but through developmental maturation and enhanced emotional regulation. Thus, judo's protective effect is neither automatic nor immediate; rather, it is mediated by duration, structure and philosophical fidelity.

Thirdly, the critical perspective explored in this essay highlights that judo is not inherently immune to misuse. When its ethical, contemplative and dialogical dimensions are attenuated, particularly in short-term, competition-centred or poorly supervised contexts, the art risks becoming fragmented. Under such circumstances, combative techniques may be decoupled from their moral framework, thereby weakening the internal safeguards intended to transform aggression into discipline and self-cultivation. Therefore, the question is not whether judo increases or decreases aggression in isolation, but under what pedagogical conditions it fulfills or betrays its founding vision.

Finally, the practical experience of initiatives such as Judo for Peace illustrates how this philosophical architecture can be translated into conflict-affected environments. From the favelas of Brazil to refugee communities in Europe and interreligious initiatives in the Central African Republic, judo has demonstrated its capacity to create shared spaces of

dignity, respect and humanisation. In these contexts, the *tatami* becomes more than a training surface; it becomes a microcosm of peaceful co-existence, where difference is encountered not as a threat but as an opportunity for growth.

Consequently, judo should not be romanticised as a universal solution to violent conflict. However, when practised in accordance with Kano's integral philosophy, supported by reflective pedagogy, and embedded within broader social initiatives, it becomes a powerful, low-cost instrument of peacebuilding. It transforms the grammar of violence into a language of discipline, mutual benefit and embodied compassion.

Thus, consistent with Kano's original aspiration and with contemporary peace theory, judo does not seek to eliminate struggle, it seeks to educate it and transform it. In doing so, it offers a realistic yet hopeful pathway: from controlled confrontation on the *tatami* to constructive co-existence in society.

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Organisation, Context and Athlete Development in Competitive Judo Kata: Insights from National Championships in the Netherlands and South Africa

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Abstract: *Kata is a fundamental component of judo, supporting technical learning and the correct application of techniques. As kata competitions grow internationally, the structure of national championships plays a key role in athlete development and in strengthening kata culture. This study presents an observational, comparative analysis of the 2025 national kata championships of South Africa and the Netherlands to examine how context shapes their organisational approaches. Both countries deliver professionally run events, yet their international outcomes differ markedly: the Netherlands has produced medallists and champions at world kata championship events, with South Africa yet to reach the podium. The Dutch championship reflects an athlete-centred model with focused organisation, expert-led education and alignment with international standards. South Africa implements a participation-orientated, resource-efficient model that broadens access and offers practical innovations such as medal clasps and participation certificates. By comparing these context-driven systems, the study identifies opportunities for both nations to enhance participation, strengthen kata development and support long-term athlete growth.*

Keywords: *kata competition; comparative analysis; sports governance; judo federations, South Africa*

Judo is a global sport with participation in 205 countries across 5 continents with practitioners of all levels and is supported by national federations that range from volunteer-run bodies to highly specialised organisations (IJF, 2024b). Long-term athlete development (LATD) and prospects for international success depend not only on athlete ability but also on the capacity and function of their federations (Nolte et al., 2017). Comparisons between the elite *shiai* systems and athlete pathways of the Netherlands, Great Britain and South Africa were examined and described by Nolte et al (2017), who highlighted key disparities and potential pathways for improvement, laying a foundation for further comparison. *Kata* are structured, co-operative exercises performed by *tori* (thrower) and *uke* (faller) that remain central to understanding fundamental judo principles (Kano & Murata, 2005; Kano et al., 2013; Otaki & Draeger, 1983; Yurievich & Sergey, 2025). The practice of *kata* by all *judoka* and especially those who compete in *shiai* is a greatly promoted concept (IJF, 2024c; Kano & Murata, 2005).

CONTEXT

Participation in *kata* has historically been more focused on its use for examinations rather than competition, resulting in less prominence than *shiai* (Bradić et al., 2017; Miranda et al., 2010). However, interest in competitive *kata* has grown substantially since the first open world *kata* event in 2007, which welcomed 78 *judoka* from 17 countries (Gatling, 2008; Miranda et al., 2010). Growth in the popularity of *kata* led to the 2025 World *Kata* Championships welcoming 466 competitors from 37 countries despite disruptions caused by the COVID-19 pandemic (Judobase, 2025).

The Netherlands, a well-developed judo nation, has secured multiple *kata* world medals and even world titles in the post-pandemic era (IJF, 2021, 2022, 2023, 2024d, 2025b). South Africa, while a leading judo nation within the African continent (IJF, 2025a), is still developing in terms of judo culture and has yet to reach the *kata* world championship podium. This disparity warrants closer examination to understand the differing developmental trajectories of these two continental leaders in *kata* competition. Major distinctions between the *shiai* systems of the Netherlands and South Africa were identified to include organisational structure, governance, resource allocation and LTAD pathways as well as national and political contexts (Nolte et al., 2017; Nolte & Hollander, 2019). No such comparable analysis has been conducted for *kata* systems, leaving significant potential for innovation unexamined.

METHODOLOGY

This study provides an observational, comparative analysis of the 2025 national judo *kata* championship events of the Netherlands and South Africa. The comparison focuses on key components of each event, including structure and organisation; facilities and infrastructure; financial elements; and proceedings. Information was drawn from the authors' first-hand observations at the respective events and from publicly available sources such as competition documents, federation websites, official policy

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Table 1: Summary of information sources within the findings' subsections.

Subsection	Source	Specific source/observation
Event structure and organisation	Documentation Documentation	Competition invitations (event structure) National documents (judo associations)
Facilities and infrastructure	Observation	Venue layout, equipment, atmosphere, amenities
Financial elements	Observation Documentation	Sponsorship, branding, merchandise Competition invitations (fees)
Proceedings	Observation Documentation Documentation Observation	Event flow, judging, entries, atmosphere IJF *kata* judge document (guidelines) *Kata* tournament regulations (standards) Award ceremonies, medals, certificates

and regulation documents. Table 1 presents a summary of the information sources utilised in the subsections within the findings. No direct data collection from individuals or groups (e.g. interviews) was undertaken. The study examines how contrasting economic and infrastructural contexts shape event organisation, participation and athlete experience. This study aims to identify systemic disparities, context-driven adaptations and shared challenges faced by two regional leaders in kata, offering insights to inform future sport policy, recognise relative strengths in each system and promote a more inclusive understanding of what constitutes a successful national *kata* championship.

FINDINGS

Event structure and organisation

The national *kata* championships in the Netherlands and South Africa differ substantially in structure, reflecting their distinct organisational priorities and resource frameworks. In the Netherlands, kata-related events (competitions, courses, regulations etc.) on a national level are managed autonomously by a dedicated national competition *kata* committee (JBN, 2025b), one of several committees within Judo Bond Nederland (JBN) (JBN, 2025a). In contrast, South Africa's championships are co-ordinated by the Judo South Africa (JSA) executive committee, indicating a more centralised system with broader oversight across multiple judo disciplines (JSA, 2025).

The Dutch *kata* championship functions as a stand-alone event focused exclusively on kata, enabling competitors to prepare with clear, singular focus (JBN, 2025b). South Africa, however, incorporates *kata* as the opening component of a five-day national event that also includes *shiai* across all age categories and adaptive judo (JSA, 2025). This integrated model enhances cost-efficiency of venue use, reduces travel demands, consolidates the availability of officials and encourages broader participation, supporting inclusivity across the judo community. These structures are displayed and contrasted in figure 1 below.

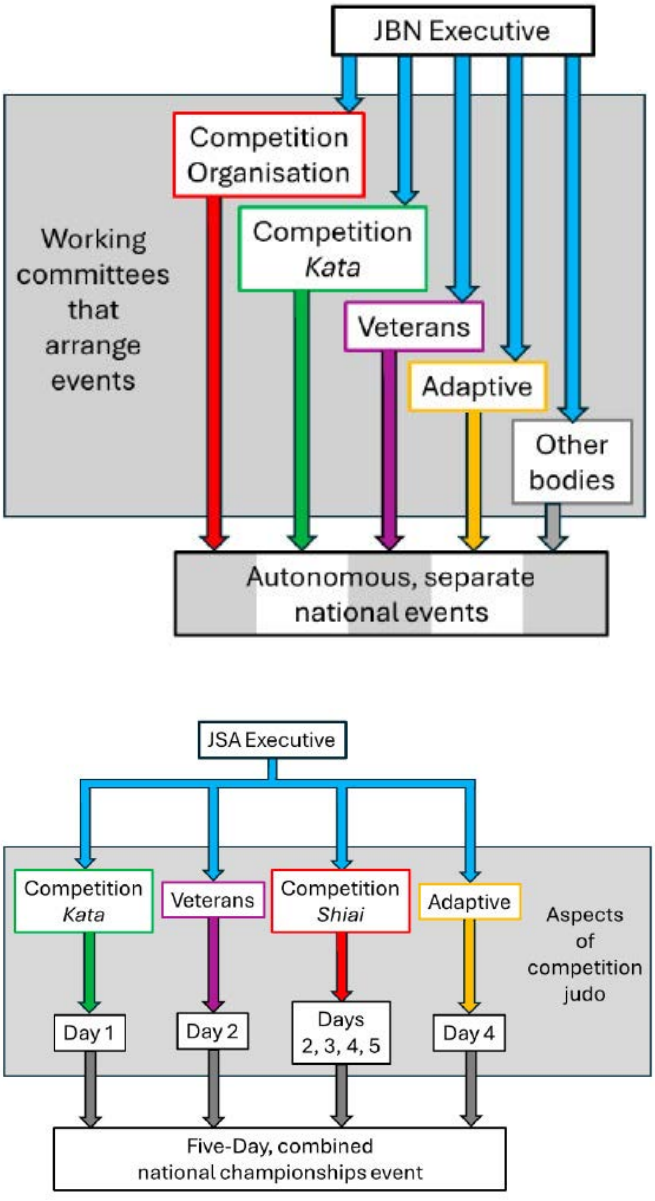

Figure 1: Comparison of organisational structure between Judo Bond Nederland and Judo South Africa.

Registration pathways also differ: Dutch pairs register directly with the national body via a member login environment on the JBN website, reflecting open access (JBN, 2025b), whereas South African entries are submitted via local districts (JSA, 2025), suggesting a more layered administrative structure, possibly as a relationship-building tool. Despite these organisational contrasts, both systems offered the full range of competition *kata* i.e. *Nage-no-Kata, Katame-no-Kata, Kime-no-Kata, Kodokan Goshin Jutsu, Ju-no-Kata*, (JBN, 2025b; JSA, 2025), ensuring comprehensive competitive opportunities.

Facilities and Infrastructure

Kata championships in both the Netherlands and South Africa conformed to high standards with fully equipped, sports-specialised facilities, although they differed notably in scale, setting and spectator engagement. The Dutch championship event was staged in a sports hall in the town of Markelo in the Overijssel province in the east of the Netherlands, where three yellow, 8x8m competition mats were laid with 2x2m blue safety zones, located across a walkway from three admission-controlled spectators' stands, spanning approximately half the length of the hall, which were nearly at full capacity, creating a highly engaged and energetic atmosphere. The downside of this venue was a fluctuating noise level (spectator-dependent) which could be distracting to competitors. The South African championship was hosted at the sports grounds of the University of Pretoria (Tuks) in Tshwane, in the Northeast of South Africa, where a central arena was laid with four yellow 8x8m competition mats surrounded by 2x2m red safety zones, three of which were utilised for the *kata* event. The name of the hosting province and year were made visible on the mats in the form of temporary branding. The venue had large permanent, raised, tiered seating overlooking the central arena. The downside of this venue in relation to the event was a feeling of isolation in the large hall due to poor spectator attendance, even with open access. The venues are represented in figure 2 below.

Figure 2: *Kata* championship venues of the Netherlands (A) and South Africa (B).

Amenities at both championships included changing rooms located close to the competition area, a designated warm-up mat in an adjoining room, and professional, designated medical service points in the main venues. General amenities such as food outlets, toilets and vehicle parking were available to all present at both championships. This suggests that regardless of economic or infrastructural challenges, both organising bodies prioritised athlete welfare, competition readiness and professional conduct. While the timing of the events were only 2 months apart, April was springtime in the Netherlands, providing extra daylight hours for travel, yet June in South Africa is wintertime, necessary for planning a five-day event in the school holiday period.

Financial elements

Notable contrasts were seen in sponsorship presence, participation costs and commercial engagement between the Netherlands and South Africa. In the Netherlands, commercial branding was displayed in the form of banners from a large supermarket chain, implying sponsorship. The South African venue had no evident sponsorship activity or branding visible, which is suggestive of the socio-economic challenges faced by South Africa in the post-COVID-19 period. Entry fees for competitors were broadly comparable when adjusted for currency value: Dutch participants paid €25 per *kata* entry and €20 for adaptive categories (A-kata) as well as for show *kata* (per group), while South African competitors paid the equivalent of €27.50 (R550) per *kata* and €3.75 (R75) per person for show *kata* participation (JBN, 2025b; JSA, 2025). The Netherlands charged a small admission fee of €2.50 per spectator (JBN, 2025b), whereas in South Africa, attendance was free of charge. There was no merchandise on sale at the Dutch event, while in South Africa essential judo items such as *judogi* and belts were sold. Collectively, these factors suggest a more commercially supported and structured financial model in the Netherlands compared to the modest, participation-focused approach seen in South Africa.

PROCEEDINGS

At both championships, competitors understood the flow of the event, though the organisational methods differed. The Netherlands used a large screen to display mat numbers and competition order, while South Africa relied on loudspeaker announcements and mat-side officials. International Judo Federation (IJF) guidelines call for multiple judges to evaluate each kata, based on their expertise and qualification(s) (IJF, 2020). This is an attempt to limit the effect of inter-judge scoring variability, inherent to highly specific *kata* evaluation guidelines for competition (Jack & Bradić, 2025). Each event employed five *kata* judges per mat and utilised standard IJF paper score sheets, which were then collected and processed electronically, reflecting consistent and cost-effective judging procedures. Both tournaments had mat-side photographers but no video or live streaming. All five *kata* and show *kata* were represented: South Africa hosted 48 entries across senior

and schools (-14 years) divisions and subdivisions, while the Netherlands had 53 entries across three age groups (-18, -21, seniors) and four adaptive categories, ranging from athletes with severe mobility challenges to former European and world champions, which is an excellent example of the inclusivity of judo

The Dutch event followed the standard European and world championship format with preliminary rounds and finals for the top four pairs (IJF, 2024a). The medal ceremony took place shortly after the last kata, with competitors and judges being presented formally before brief yet inspiring addresses by the competition director and national *kata* coach, who also announced the date of the annual Kodokan *kata* course, typically held in August annually and at the same venue as the championships. Competitors and judges gathered around the podium for the medal presentation, creating a strong sense of community and sportsmanship. South Africa prioritised efficiency with a single performance per pair and immediate medal presentations following each category. This approach reduced time demands significantly but diverged from international practice and limited the collective recognition typically afforded to medallists.

Both championships awarded high-quality, judo-specific medals labelled with the national federation name and suspended on ribbons in national colours. South Africa added a distinctive clasp identifying the event, year, location and 'Kata' (see figure 3). This simple yet innovative addition to the medal makes it more distinct and identifiable from any other medals that the participants might have received. JSA also issued certificates to all *kata* competitors, acknowledging participation and results regardless of medal placement. The reverse of the Dutch medals was engraved and specific per kata, with 5 lines detailing placing ('Kampioen', 2e plaats', 3e plaats'), 'Nederlandse Kampioenschappen,' '*Kata* 2025' and the name of the specific *kata* (e.g. '*Kime-no-Kata*').

Figure 3: Dutch and South African championship medals

DISCUSSION

The spirit of sportsmanship and unity within the Dutch *kata* community was evident, particularly during the awards ceremony. Family and peer support, together with encouragement from the head of the *kata* committee and the national *kata* coach offered athlete-focused praise and motivation. Collaboration between these organisational spheres helps strengthen community cohesion and maintain athlete engagement in their *kata* development. This engagement is further supported by reasonable participation and spectator fees and by travel distances that are less than three hours by vehicle from any point in the country. Such accessibility enables regular attendance at local and national events, providing numerous progression opportunities along the LTAD pathway. In addition to club and district training, the annual expert-led, two-day *kata* course strengthens the body of *kata* knowledge for *judoka* at all levels, as well as for coaches, officials and judges. A potential area for further growth lies in attracting more active *judoka* to *kata* practice and competition. Taking advantage of inexpensive avenues to enhance athlete promotion and encouragement could help achieve this. The Dutch *kata* championship is best characterised as an athlete-centred event driven by focused organisation, education and internationally aligned standards.

In contrast to the Netherlands' compact geography and dense athlete base, South Africa's more modest judo population is dispersed across a vast country and necessitates substantial organisational adaptation. The direct and associated costs of travelling long distances, often up to 20 hours by vehicle, in a challenging economic climate, make consolidating events both practical and essential. Hosting separate *kata* and *shiai* championships would increase financial pressure on *judoka* and their families significantly and risk fragmenting participation if competitors were forced to choose between events. Thus, combining all disciplines into a single five-day national championship, despite some compromises in preparation and focus, remains the most viable and context-appropriate approach. While establishing a dedicated *kata* sub-committee could strengthen event organisation and *kata* development, its feasibility depends on securing enough experienced and committed volunteers within a relatively small judo community.

The inclusion of a schools' participation category provides an accessible means of early exposure to kata, and if promoted further, could help embed *kata* more firmly within the athlete LTAD pathway. While both countries' medals were of high quality and contained details of the event, year and category (kata), the Dutch medals needed to be turned around to view these details. South Africa's use of customisable medal clasps and participation certificates exemplifies a cost-effective strategy that maintains medal identity, supports bulk procurement of the base medals, reduces wastage of unused medals and enhances athlete experience. Although no spectator fee limits potential income, introducing one would likely depress already modest attendance and offer little financial benefit. Overall, the South African *kata* championship is best characterised as a participation-orientated event shaped by pragmatic, resource-efficient functionality.

CONCLUSION

Understanding the national *kata* championship environments in the Netherlands and South Africa highlights how organisational approaches and context-driven adaptations shape each event. Both deliver professionally run championships, yet they differ in how *kata* is positioned and promoted within their broader judo structures.

The Netherlands benefits from a focused structure that supports sustained attention to *kata* development. This is evident in competitor and official engagement, expert-led educational programmes and strategic use of specialised knowledge, creating a cohesive system that strengthens domestic *kata* culture and aligns with international standards. South Africa, in contrast, demonstrates adaptability, efficiency and cost-conscious strategies that broaden participation. While *kata* is included, it is not singularly driven. Increasing *kata* focus through cost-effective measures such as educational courses (physical and online) may enhance active participation and chances of international success. Practical innovations, such as medal clasps and participation certificates, provide low-cost enhancements that could also enrich the Dutch athlete experience.

Together, these championships demonstrate that successful national *kata* events can emerge through diverse, context-specific models and adaptations. By recognising and leveraging each other's strengths, both nations have opportunities to support athlete development, increase participation and maximise the impact of *kata* within judo.

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The Status and Awareness of Shime-waza In Junior High School Judoka

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Abstract: *Shime-waza (strangle techniques) in judo have been prohibited for junior high school judoka in Japan since 2022 due to concerns about its effects on the skeletal development of adolescents. However, its psychological and physical effects are largely unknown. Here, we hypothesised that the experience of unconsciousness by shime-waza has psychological impacts on junior high school judoka. For this purpose, questionnaires on shime-waza and unconsciousness, together with the IES-R (Impact of Event Scale-Revised) test for post-traumatic stress disorder, were administered to 340 judoka (224 male and 116 female) from judo clubs at junior high schools or local towns. As a result, 25.0% of males and 17.4% of females experienced unconsciousness, while 20.3% of males and 18.3% of females made opponents unconscious. For 84.3% of males, instructors were present at the time of the most severe unconsciousness, and 49.1% of judoka reported the event of unconsciousness to their instructors. About 91.1% of judoka returned to judo within 1 hour after the event, while 6.4% of judoka were injured after the event, resulting in unconsciousness. IESR evaluation revealed that 10.9% of judoka, who experienced receiving or providing fainting, showed the above cut-off points. Interestingly, IESR scored significantly higher in judoka who never dropped opponents compared with judoka with experience in dropping opponents, concomitant with the elevation of 'Avoidance,' a subscale of IESR. It could be a tendency to decrease anxiety following the experience of rendering opponents unconcious. This study is significant because it investigates unconsciousness by shime-waza from the perspective of post-traumatic stress for the first time in judo.*

Keywords: *shime-waza, fainting, IESR, post-traumatic stress, school age*

Judo is an Olympic combat sport characterised by high-intensity intermittent activity and a wide range of technical skills. Jigoro Kano systematised judo techniques theoretically in the 1880's (Watson, 2000), in which *shime-waza* (i.e., judo choke techniques) were retained. *Shime-waza* may result in transient loss of consciousness (TLOC), either when a *judoka* is rendered unconscious by his/her opponent's choke or when a *judoka* renders the opponent unconscious through the application of the choke technique.

Biological responses to *shime-waza* have been investigated in older studies (Ikai and Ishiko et al., 1958; Ikai and Yamakawa et al., 1958; Suzuki, 1958; Ogawa et al., 1963) and others (Reay et al., 1982; Raschka et al., 1996; Rau et al., 1998; Haga et al., 2016; Kato et al., 2017). Since 2022, the All Japan Judo Federation (AJJF) has prohibited the use of *shime-waza* in competition for junior high school students aged 12 to 15. The main reason cited was the fragility of the neck in adolescent *judoka*, as their skeletons and brains are still developing. However, the safety aspect of *shime-waza*, including unconsciousness, is still controversial because fatality numbers are very low in judo (Koiwai, 1987). In fact, no case of transfer to the hospital was reported after receiving *shime-waza* during the period 2005-2022 in 157 top EU competitions involving a total of 39415 competitors (Smoulders, 2021), indicating that *shime-waza* techniques in judo are safe. The mechanisms underlying unconsciousness may be complex (Stellpflug and Menton et al., 2020; Nimura et al., 2022), presumably due to differences in *shime-waza* techniques and the location of peak pressure on the neck.

In university *judoka* (average age 19.7), 29 of 287 *judoka* (10.1%) kept recognising the fear of unconsciousness after the worst incident of unconsciousness by *shime-waza* (average age 14.8) (Kamiya, et al., 2023), postulating that the fear of unconsciousness from *shime-waza* experienced at the juvenile age (i.e. junior high school) can last at least 5 years in the memory of *judoka*. In addition, Japanese *judoka* felt significantly more fear of *shime-waza* than non-Japanese *judoka* (Japan: 62.3%, non-Japanese: 22.1%, $p<0.001$) and of being rendered unconscious by *shime-waza* than non-Japanese *judoka* (Japan: 72.3%, non-Japanese: 29.8%, $p<0.001$) (Yamamoto et al., 2024). Therefore, the Japanese population as an object of study would be worth examining, given the fear of *shime-waza* and fainting.

When stress has a severe psychological impact, the experience may persist in memory, continuing to have a psychological effect. The psychological sequelae resulting from such experiences are specifically termed psycholo-

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gical trauma, and the resulting psychological disturbances are referred to as post-traumatic stress reactions (PTSR). Although most cases of PTSR are transient and the symptoms are often mild, some cases become chronic and can cause considerable distress in the individual's subsequent social life. Post-traumatic stress disorder (PTSD) is one such condition arising from such trauma. It has been reported that athletes who have experienced trauma due to sports injuries may exhibit PTSD (Aron et al., 2019).

Currently, in many countries, *shime-waza* techniques have been introduced from ages 12 to 15. However, the psychological and physical effects of *shime-waza* and fainting are largely unknown. Here, we hypothesised that the experience of unconsciousness by *shime-waza* in junior high school age students has psychological and latent impacts on *judoka*. In this study, questionnaires about *shime-waza* and unconsciousness were completed for junior high school *judoka*, together with one of the psychological evaluations for PTSD, IES-R (the Impact of Event Scale-Revised). It is noted that participants in this study use *shime-waza* daily because the study was conducted before the AJJF prohibited their use with junior high school *judoka* aged 12 to 15, in 2022.

METHOD

This study was approved ethically by the affiliated institution (Tenri University No. 22-012). The survey was conducted in the 2021 academic year, before the prohibition of *shime-waza*, targeting junior high school *judoka* who practise judo at school or a local judo club. The questionnaire, consisting of 73 questions, was administered via paper and Google Forms. The questionnaire includes 9 basic information questions (e.g., gender, age, school grade, judo grade) and 17 questions about the value of *shime-waza* for all participants. Additionally, 25 questions on medical and safety management (Kamiya et al., 2023) and 22 questions from the IES-R (Weiss and Marmar, 1997), hereafter referred to as IESR, were administered to those who had experience rendering opponents unconscious or being rendered unconscious by opponents. It should be noted that if participants had experience of fainting twice or more, they were asked to report the most memorable (severe) episode.

The IESR is a scale designed to measure psychological trauma symptoms, particularly with PTSD in mind (Weiss and Marmar, 1997), and is used internationally as a PTSD assessment tool for athletes following sports injuries (Padaki et al., 2018). Each *judoka* scored the items by focusing on the transient, unconscious event of *shime-waza*. For screening, individuals at high risk of traumatic stress symptoms, a cut-off point of 24/25 points is recommended; a score of 25 points or above is considered indicative of a high risk of developing PTSD. The 22-item IESR is structured around three conceptual elements: intrusion (8 items), avoidance (8 items), and hyperarousal (6 items), which are used as subscales. The maximum IESR score is 88 points (i.e., 4 points × 22 items). IBM SPSS Statistics 29 was used for statistical analysis, employing non-parametric tests (Mann-Whitney U test). Values were expressed by mean ± SD (standard deviation). The significance level was set at 5%.

RESULTS

Background data

Here, we showed the basic information of participants, including gender, age at the time of the survey, and judo grade at the time of the survey (Table 1).

Table 1. Background data of participants at the time the questionnaires

n=340		Male	Female	Total
Gender		224	116	340
Average age		13.7±0.9	13.6±0.9	13.8±0.9
School grade	First year grade	99	35	134
	Second year grade	82	46	128
	Third year grade	43	35	78
Judo grade	White or Brown	180	75	255
	Black - 1. Dan	42	33	75
	Black - 2. Dan	2	8	10

Participants were aged 12 (8.2%), 13 (37.4%), 14 (35.9%) and 15 (18.5%) with an average of 13.7±0.9 (Male: 13.6±0.9, Female: 13.8±0.9), and graded for the first school year (39.4%), the second school year (37.6%) and the third school year (22.9%). In Japan the fiscal year begins in April and ends in March and there are three fiscal year groups as school grade in junior high school (first year: age 12-13, second year: age 13-14, third year: age 14-15). For judo grade, 75% of participants were white or brown belt, 22.1% were black belt with the first grade, and 2.9% were black belt with the second grade (Table 1).

Shime-waza experience and fainting

75.0% of participants practise *shime-waza* techniques and 69.1% use them in competitions (data not shown). Among the participants, 23.4% had experience of fainting; i.e., unconsciousness caused by opponents, without gender difference (male: 24.0%, female: 22.4) (Figure 1).

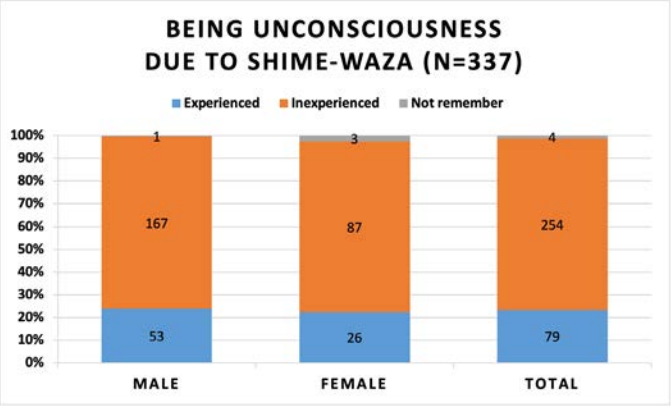

Figure 1. Experience of becoming unconsciousness from opponent's *shime-waza*

Similarly, the experience of rendering opponents unconscious through *shime-waza* was 19.6%, with no significant difference by gender (male: 20.3%, female: 18.3%) (Figure 2).

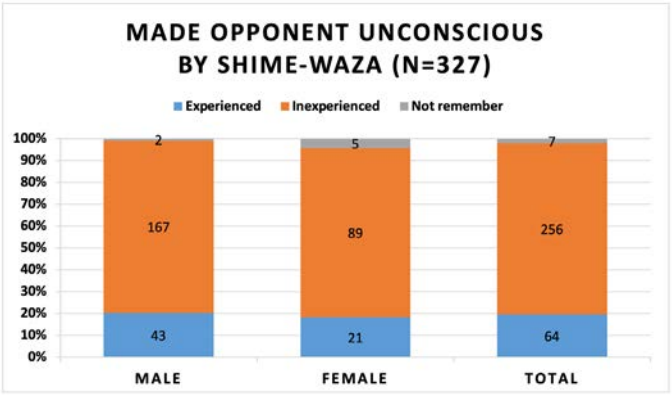

Figure 2. Experience of making an opponent unconsciousness by *shime-waza*

The worst memorable case of fainting

If each *judoka* experienced unconsciousness by *shime-waza* more than twice, the worst memorable case of unconsciousness that the *judoka* can recall was focused on afterwards. The average age and school grade in which the *judoka* experienced the worst case of fainting, were 12.9±0.8 (male: 13.0±0.7, female: 12.9±1.0), which was significantly younger ($p<0.001$) and lower ($p<0.001$) than the age and the school grade at the survey (Table 2, compared to Table 1). In addition, the judo grade at the time of suffering the worst unconsciousness episode was significantly lower than that at the survey ($p<0.001$) (Table 2).

Table 2. Sequential data of participants at the time of the worst memorable event of fainting

n=79		Male	Female	Total
Gender		53	26	79
Average age		13.0±0.7	12.9±1.0	12.9±0.8
Judo grade	White or Brown	28	18	46
	Black - 1. Dan	5	6	11
	Black - 2. Dan	0	0	0

Interestingly, a small number (6.4%, 5 of 78 cases) continued to recognise the feeling of fear until the time of the survey, following the most severe event of unconsciousness by *shime-waza* (not shown).

Regarding the environments of the *judoka*, 87.0% of *judoka* were in the class of judo practice with their coaches at the time of transient loss of consciousness (Figure 3), while only 55% reported their unconsciousness to their responsible coaches (Figure 4).

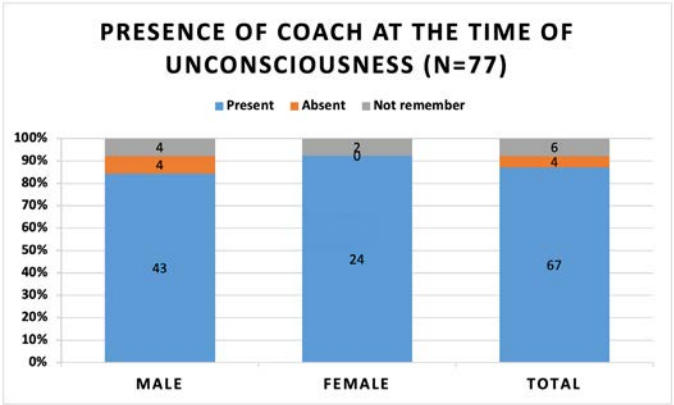

Figure 3. Presence of the coach with the *judoka* at the time of unconsciousness

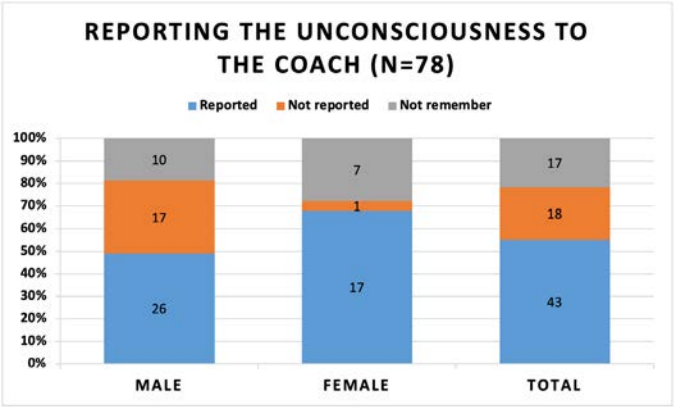

Figure 4. Report the event of being unconscious to the responsive coach

After recovery from the loss of consciousness, 91.1% (72 cases) of *judoka* returned to judo within 1 hour and no-one went to see a doctor for medical examination (Table 3). Note that 75.9% (60 cases) resumed judo immediately without any rest after recovering from unconsciousness by *shime-waza*.

n=79	Male	Female	Total
Immidiately without rest	38	22	60
Rest for 30 min to 1h	9	3	12
1 day rest	4	0	4
1 week rest	0	0	0
See a doctor for approval	0	0	0
Other	2	1	3

Furthermore, a small number (5 cases, 6.4%, 4 male and 1 female) experienced additional injury following recovery from the loss of consciousness (Figure 5). Out of 5 cases, 80% (4 cases) returned to judo immediately after the event of fainting and the remaining 1 case was undetermined for the timing of their return to judo after the event.

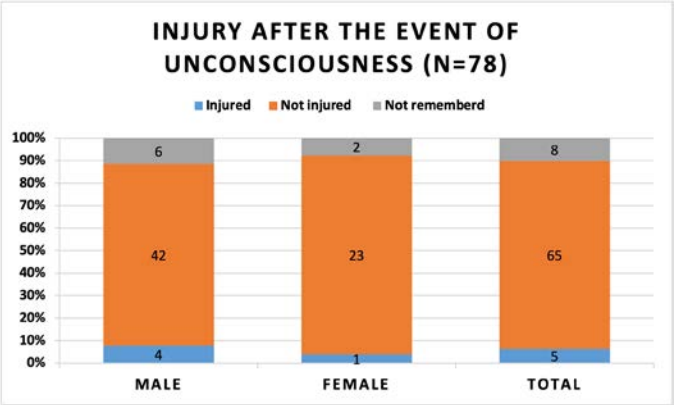

Figure 5. Sequential injury after the event of unconsciousness by *shime-waza*.

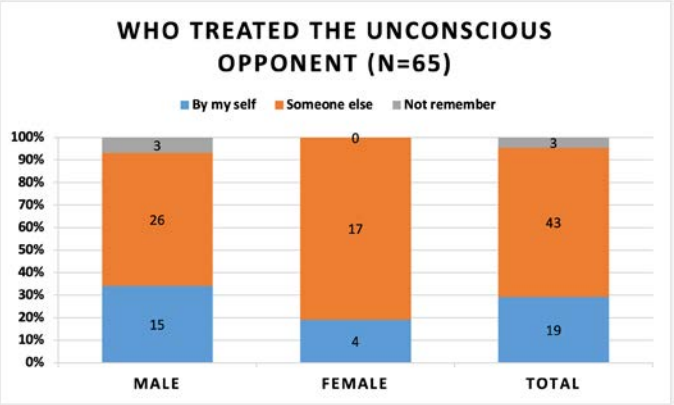

Figure 6. The person who treated the unconscious opponents.

In addition, recalling rendering the opponent unconscious through the application of *shime-waza* can evoke unpleasant feelings or anxiety in about 11.1 % (7 of 63 cases, data not shown).

The psychological impact of unconsciousness by *shime-waza* on junior high school *judoka*

Of 340 participants, 101 *judoka* who had experience of either being rendered or rendering opponents unconscious answered the IESR, which has been used internationally as a PTSD assessment tool for athletes following sports injuries. IESR is capped at 88 points (4 points for each of 22 questions). In this study, 64.4% (65 cases) scored below 5 points (i.e., 0 points: 41 cases; 1 point: 24 cases) (Figure 7). It is noted that 10.9% (11 cases: 8 male, 3 female) scored above the cut-off point (i.e., 24/25). The average was 8.7±15.0, where there was no significant difference by gender (male: 8.7±15.2, female: 8.5±14.7).

When we compared the *judoka* with experience of fainting (i.e., being rendered unconscious by opponents) to those without fainting, there was no difference in the IESR score as well as its subscales, intrusion, avoidance, and hyperarousal between the two groups of *judoka* (Figure 8).

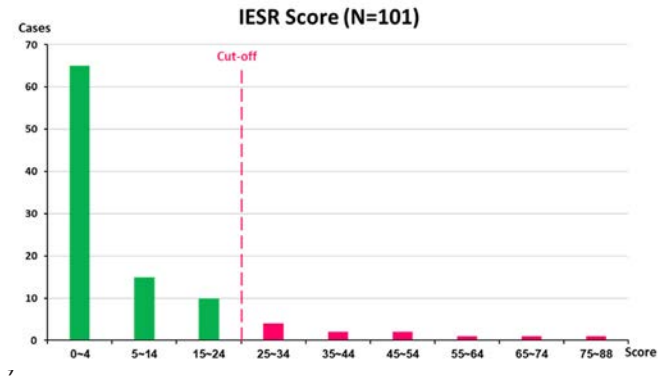

Figure 7. IESR score for junior high school *judoka* who had experience of either fainting or rendering opponents unconscious by *shime-waza* (case number)

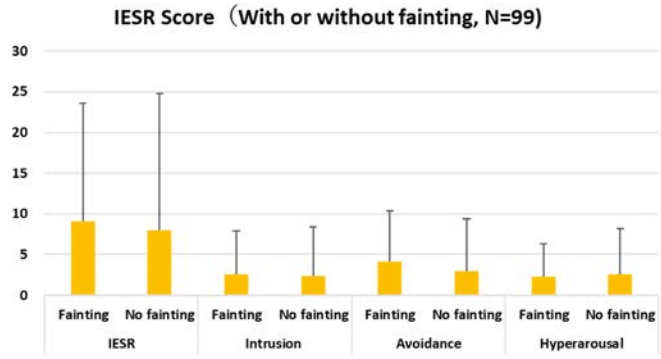

Figure 8. The comparison of the IESR score and its subscales between *judoka* with/without fainting (score)

When we compared the *judoka* with experience in rendering opponents unconscious to those without rendering opponents unconscious, both the IESR score (p=0.021) and one of the subscales, avoidance (p=0.007), were significantly lower in the group of *judoka* with rendering opponents unconscious compared with *judoka* without rendering opponents unconscious (Figure 9).

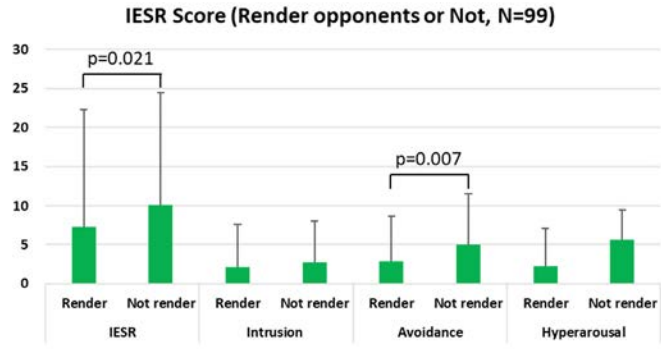

Figure 9. The comparison of the IESR score and its subscales between *judoka* with/without rendering opponents unconscious (Score)

DISCUSSION

To the best of our knowledge, this study is the first to measure post-traumatic stress symptoms, with PTSD in mind, in relation to 'fainting' in judo. Not everyone who experiences trauma develops PTSD. The lifetime prevalence of PTSD has been reported as 5% for men and 10% for women (Kessler et al., 1995), and the IESR is used to screen for PTSD-related symptoms. In this study, 11 junior high school *judoka*, including 8 male and 3 female, had an IESR score exceeding the cut-off value (25 points or more, Figure 7), and this was observed in 10.9% (male: 11.8%, female: 9.1%) of *judoka* who had experienced either being rendered or rendering opponents unconscious or 3.2% (male: 3.6%, female: 2.6%) of participants in this study (i.e. 340 *judoka*, Table 1). In contrast, for traumatic experiences such as major natural disasters, including earthquakes, the proportion of cases where IESR scores exceed the cut-off value has been reported to range from 10.8% to 39.5%. Therefore, compared to natural disasters, it is considered that the trauma from the experiences of being rendered or rendering opponents conscious in this study causes psychological trauma less frequently. The IESR had a sensitivity of 89% and a specificity of 93% in the early phase, and a sensitivity of 75% and a specificity of 71% in the long-term phase (Asukai et al., 2002). In this study, the IESR score was significantly higher in the group without experience of rendering opponents conscious, and avoidance symptoms contributed to this effect as a subscale (Figure 9).

Based on the above results, several hypotheses can be considered to explain why the IESR score is lower in the group with experience of rendering opponents unconscious. The first is the possibility that the negative impression held before the experience of rendering opponents unconscious changed into a positive one through actually experiencing it; this is the case where one's own experience of being rendered unconscious by opponents was originally very painful (high IESR), but it became a 'signature move' through the use of the *shime-waza* techniques. Consequently, the IESR diminishes and recalling the *shime-waza* incident no longer causes distress (low IESR). Another possibility is that individuals with low IESR scores (low stress response) may have engaged in the act of rendering others unconscious frequently to begin with. It would be simplistic to interpret that anxiety and negative perceptions regarding rendering opponents unconscious are dispelled only through the experience of doing so, leading to an acceptance of the value of *shime-waza* and fainting; further examination of the relationship between rendering opponents unconscious and stress responses is required. Further investigation is desired as to whether the phenomenon (i.e., the paradoxical finding that performing a choke on an opponent correlates with lower levels of anxiety and avoidance) results from the development of a sense of psychological control over a dangerous situation or a form of desensitisation to trauma.

A limitation of this study is that it used a cross-sectional design and was not appropriate for the investigation of changes in IESR scores over time. In addition, from the point of view of survivorship bias, this study did not include athletes who have left judo permanently, potentially due to the trauma they experienced, including unconsciousness by *shime-waza*. Analysing these factors alongside changes in attitudes towards *shime-waza* have been identified as tasks for future research.

However, unlike the experience of a major earthquake, which could occur only once in a lifetime, the experience of being rendered unconscious in judo is likely to recur as long as *judoka* continue to practise judo. It is important to note that prior traumatic experiences increase the risk of developing PTSD following a subsequent traumatic event (Widom, 1999). A dose–response relationship has been demonstrated for various types of traumatic stress; the higher the intensity of the stressor, the higher the incidence of PTSD, and it is thought that the severity of the shock itself has a significant influence on the onset of the condition, while pre-existing vulnerability also plays a major role (March, 1993). Junior high school *judoka* are considered to be in a vulnerable state, both physically and mentally, as they are still developing. However, the effects of repeated stress remain unclear. Therefore, when screening junior high school judo practitioners, it will be necessary to monitor their subsequent progress.

It is reported that 14.0% of junior high school students who had experienced fainting exhibited a variety of subjective symptoms (unsteadiness, numbness in the limbs, dizziness, nausea/vomiting, and headache) upon regaining consciousness and that in over 90% of these cases, the symptoms disappeared within one hour (Ikumi et al., 2021). In this study, the finding that 91.1% of *judoka* resume judo within 1 hour of fainting (Table 3) is concerning. Indeed, 6.4% of *judoka* (5, 4 male and 1 female) reported that they did not stop judo practice (or matches) after recovering from fainting and, as a result, sustained an injury. A survey of university *judoka* also identified a correlation between fainting from *shime-waza* and head injury (Kamiya et al., 2023), suggesting the possibility of a head injury following the most severe fainting experienced during junior high school. Furthermore, it has been reported that young *judoka* experience a loss of consciousness due to *shime-waza* more frequently than adults (Sasaki et al., 2022). It will be necessary to establish guidelines from a medical perspective regarding the resumption of judo following fainting among young *judoka*, in order to prevent secondary injuries, including head injuries.

As mentioned earlier, *shime-waza* were prohibited for junior high school *judoka* in Japan from April 2022. Similar concerns remain unresolved even among senior high school *judoka* (age 15 to 18), who are currently permitted to start using *shime-waza* in Japan; it is therefore necessary to expand the scope of future investigations to include senior high school *judoka* and examine the effects of *shime-waza* on *judoka*. Given that this study suggests *shime-waza* may contribute to traumatic stress, the use of the IESR for *judoka* should be considered a novel ap-

proach. Moving forward, initiatives targeting young *judoka*, including junior and senior high school students, will be essential to the growth and development of the judo population. We believe there is significant value in disseminating findings internationally, based on scientific evidence and utilising various PTSD assessment scales, including the IESR, regarding the mental and physical damage caused by *shime-waza* and following unconsciousness.

CONCLUSION

Before the prohibition of *shime-waza* techniques for junior high school *judoka* in Japan, a survey was conducted to assess their attitudes towards *shime-waza* and fainting. In 340 participants, traumatic experiences, including being rendered or rendering opponents unconscious, were observed in 23.4% and 19.6% of *judoka*, respectively. The most severe, memorable fainting occurred during the earlier period of school grade and judo grade. Regarding scores on the IESR, a PTSD assessment scale, 10.9% of *judoka* exceeded the cut-off point. Interestingly, in the group without experience of rendering opponents unconscious, IESR and its subscale avoidance scored significantly higher than in the group with experience of rendering opponents unconscious. Based on the findings here, it is possible that experiencing rendering opponents unconscious may lead to recognition of the value of *shime-waza* and fainting, thereby reducing anxiety. Issues regarding the judo environment for junior high school *judoka*, such as reporting fainting to coaches and the timing of resuming judo, were identified and appropriate safety management and coaching methods for the future should be discussed. It is also very important to develop a universal return-to-play protocol for unconsciousness due to *shime-waza*, because currently each judo federation has its own published protocol and some adopt concussion protocols, while the condition of concussion can differ from loss of consciousness by *shime-waza* (Singh et al., 2025). To support the growth of the judo population, it is necessary to conduct surveys to examine the psychological effects of *shime-waza* and fainting among young *judoka*, including junior and senior high school students.

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Bilirubin as an Adaptive Oxidative Stress Biomarker in Judo Athletes: A Pilot Study Using Non-invasive Biological Matrices

By Paola Sist[1], Ludovico Urbani[2], Federica Tramer[1] and Ranieri Urbani[3]

Abstract: *This pilot study evaluates bilirubin as a potential adaptive biomarker of psychophysical and oxidative stress in judo athletes, moving beyond its traditional role in liver function assessment. Bilirubin and its conjugate were quantified in nine athletes before and after training and competition using the high throughput fluorometric 'HUG' assay. Results were compared with cortisol, amylase and malondialdehyde levels across blood, urine and saliva samples.*

Intense exercise induced significant post-activity increases in bilirubin which correlated positively with established oxidative and psychophysical stress markers. Notably, urine emerged as the most sensitive and effective matrix for non-invasive monitoring of bilirubin fluctuations. The findings suggest that bilirubin could serve as a potential biomarker of antioxidant response and recovery. Incorporating this biomarker in non-invasive monitoring protocols may contribute to the enhancing of practical tools for optimising workload and reducing the risk of overtraining in elite sport.

Keywords: *Biomarkers, bilirubin; cortisol, amylas;, oxidative stress, non-invasive monitoring*

An understanding of the impact of exercise-induced psychophysiological stress has received considerable attention in recent years, regarding performance and fatigue. Most studies conducted over the past two decades have consistently reported an increase in oxidative stress following acute exercise, whether aerobic or anaerobic, supporting the concept that exercise induces oxidative stress regardless of the type or intensity of activity (Fisher-Wellman & Bloomer, 2009; Kawamura & Muraoka, 2018; Squillacioti et al., 2021). Judo, in particular, is an acyclic sport for which performance depends on a combination of different physical abilities. It is a sport with high intensity and intermittent actions. Therefore, both the aerobic and anaerobic metabolic systems are alternately stimulated (Franchini et al., 2011; Gandouzi et al., 2023).

Physical activity is closely associated with oxidative stress, a condition defined by an imbalance between the production of reactive oxygen species (ROS) and the body's antioxidant defenses (Power et al., 2020). During intense or prolonged exercise, the elevated oxygen consumption in muscles promotes the generation of ROS and reactive nitrogen species which can damage lipids, proteins and DNA, contributing to muscle fatigue, inflammation, and, in severe cases, an increased risk of overtraining (Finaud et al., 2006) and injuries (Lewis et al., 2020; Wang, 2021; Lui et al., 2022).

However, moderate levels of ROS play a positive role: they activate cellular signaling pathways, promote muscle adaptation and enhance endogenous antioxidant systems such as superoxide dismutase, catalase and glutathione peroxidase (Power et al., 2020). This phenomenon, known as hormesis, explains why regular exercise reduces the risk of chronic diseases and premature ageing (Meng & Su, 2024). Balance is therefore crucial: calibrated workouts and a diet rich in natural antioxidants improve the ability to counteract oxidative stress, while excessive and untargeted supplementation can hinder beneficial adaptations. An intriguing idea is to elevate endogenous antioxidants through physical activity, creating a virtuous cycle in which controlled stress produces a beneficial oxidative status that amplifies health benefits.

The use of biomarkers has become an essential monitoring tool in the field of sport and exercise medicine. Among these, in addition to being a good biomarker of oxidative stress, bilirubin is an excellent candidate as a powerful antioxidant. Bilirubin is recognised as a potent endogenous antioxidant, more effective than vitamin E at neutralising reactive oxygen species (Woronyczová et al., 2022). These properties suggest that moderately elevated bilirubin concentrations may provide adaptive and protective advantages in response to oxidative and inflammatory stress, reducing cardiovascular risk (Zuo et al., 2022) and lowering the incidence of metabolic syndrome (Nikouei, 2024).

Athletes, especially elite athletes, tend to have higher bilirubin levels than sedentary individuals. This appears to be a protective adaptation to the increased oxidative and inflammatory stress caused by intense exercise. Current

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evidence suggests that these elevations may generally reflect physiological adaptation rather than pathology (Witek et al., 2017). These authors reported that 18 – 20% of athletes display bilirubin levels above the reference range established for the general population, in the absence of clinical abnormalities, and proposed athlete-specific limits with an upper threshold of approximately 29 µmol/L. Consequently, bilirubin should be interpreted not only as a marker of liver damage but also as a potentially beneficial factor for health and athletic performance (Flack et al., 2023).

The transition from understanding bilirubin's biological role to its practical application in sports science lies in its sensitivity to training volume and intensity. Unlike static clinical markers, bilirubin serves as a dynamic indicator of the athlete's current redox status (Di Gioia et al., 2023). By tracking its fluctuations, practitioners can distinguish between beneficial physiological adaptation (hormesis) and excessive oxidative debt that may lead to maladaptation. Therefore, incorporating bilirubin into routine screening could extend beyond traditional liver health assessment and may provide a non-traditional metric to gauge recovery and quantify the metabolic cost of high-intensity effort, such as those encountered in judo.

Monitoring athletic performance during training and competition requires analytical methods that are fast, simple and inexpensive, along with non-invasive sampling techniques which are capable of indicating any psychological or physical imbalance at an early stage to prevent failure or injury.

RESEARCH AIMS AND HYPOTHESES

Based on the current gap in literature regarding multi-matrix stress assessment in combat sports such as judo, the primary objective of this pilot study is to evaluate the feasibility of using bilirubin as a potential adaptive biomarker for athlete monitoring by comparing its levels with standard psychophysiological stress markers across different biological matrices (urine, saliva and blood). The specific objectives were the assessment of the acute response of bile pigments and stress parameters before and after exposure to standardised training and competitive judo events, identifying individual patterns of oxidative stress.

We hypothesise that (1) bilirubin levels will show significant acute fluctuations in response to judo-specific loads, reflecting its consumption as a primary antioxidant, and (2) these variations will correlate with changes in established stress biomarkers, thereby validating bilirubin as a reliable and accessible indicator of an athlete's psychophysiological state. The final hypothesis is that higher bilirubin levels may contribute to metabolic and performance-related benefits, such as increased endurance, vascular protection and improved fat oxidation.

METHODS

The experimental design presents this study as an exploratory and feasibility study with an embedded case observation on the use of bilirubin as an additional marker among indicators of athletes' oxidative status.

Subjects and sampling protocol

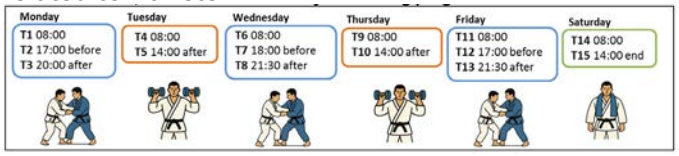
Nine medium-level *judoka* (four male, five female) from the Friuli Venezia Giulia region, Italy, were recruited. The study was submitted to and approved by the ethics committee of the University of Trieste. All participants confirmed they were in good health, were non-smokers and were not taking any supplemental vitamins or antioxidants, following an established protocol (Sist & Urbani, 2022). One of these athletes was then selected for closer observation during a one-week judo session to determine parameter values across the three different biological fluids. Biometric parameters for all participants are reported in Table 1.

Table 1. Subjects physical characteristics.

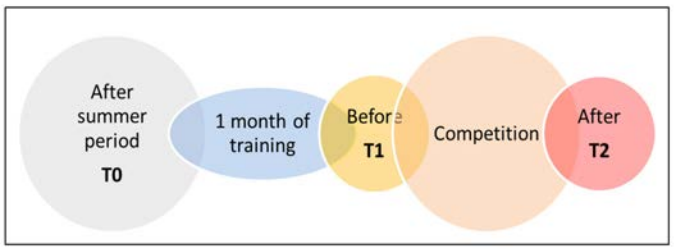
	#	Age (years)	Judo practice (year)	Training (h/week)	Hight (m)	Weight (kg)	Body Mass Index (kg/m^2)
Male	1	22	18	8	1,90	128	35.5
	2	18	11	5	180	90	27.8
	3	17	12	10	164	63	23.7
	4	16	7	8	177	90	28.7
Female	5	27	22	8	160	60	23.4
	6	18	13	8	168	65	23
	7	16	7	5	157	55	22.3
	8	14	8	4	159	53	21
	9	14	8	5	153	63	26.9

Blood, saliva and urine samples for athlete 1 were collected as shown in Scheme 1, while urine and saliva samples from the other athletes were collected as shown in Scheme 2.

Scheme 1. Blood, saliva and urine weekly programme related to Athlete 1.



Scheme 2. Monitoring programme including a competition event.



Samples were self-collected, non-invasively, by the athlete at home or in the gym. After receiving thorough instructions, saliva was collected, without stimulation, using a sterile Salivette (Sarstedt®) and urine was collected in a sterile 50 ml Falcon tube. These samples were trans-

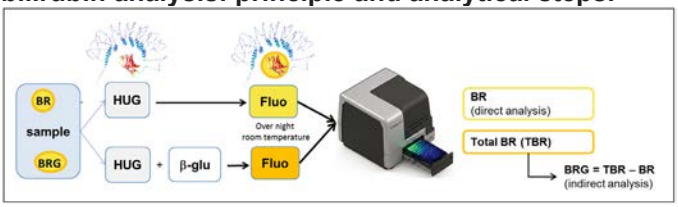
ported promptly to the laboratory and frozen at -80°C for analysis (Sist et al., 2022). Capillary blood was obtained using a finger-prick device. The resulting drop was collected in a sterile vial and transferred immediately by an operator using an automatic pipette.

HUG fluorometric assay

The quantification of bilirubin (BR) and its congener bilirubin glucuronide (BRG) employed a high-throughput fluorometric method (Scheme 3) based on the selective high-affinity binding of bilirubin to the HELP-UnaG (HUG) fusion protein (Sist & Urbani, 2022; Sist et al., 2023; Sist et al., 2025). The assay can be enhanced for the measurement of conjugated bilirubin (BRG) by adding the enzyme beta-glucuronidase to the reaction mixture (Pelizzo et al., 2023).

Small sample volume (5 µL of blood, 200 µL of saliva, or 100 µL of urine) was added to HUG solution with or without β-glucuronidase enzyme (β-glu).

Scheme 3. HUG method of bilirubin and conjugated bilirubin analysis: principle and analytical steps.



Biochemical parameters

Creatinine (CRE) was determined using the Jaffe method (1886). Cortisol was extracted from saliva and urine with dichloromethane and analysed via HPLC-UV based on a method by Pihut et al. (2015) with modifications. Malondialdehyde (MDA) was measured in all matrices by HPLC with fluorescence detection after derivatisation with thiobarbituric acid, following Agarwal & Chase (2002). Amylase activity in saliva and urine was quantified using a commercial assay kit (Sigma-Aldrich).

Statistical methods

Using R and ggplot2, a Kendall correlation matrix was generated to assess statistical associations between variables. Kendall's τ coefficient was used because it is non-parametric and suitable for non-normal distributions and provides accurate correlations with limited data points. Given the exploratory nature of this study, no correction for multiple testing was applied. Results should be interpreted as preliminary and require replication in a confirmatory study.

RESULTS AND DISCUSSION

Bilirubin is a molecule with multiple functions, such as antioxidant, anti-inflammatory and regulatory effects (Schwertner & Witek, 2008; Vitek & Ostrow, 2009; Hammouda et al., 2012; Creeden et al. 2021) Moreover, in high-intensity training, bilirubin acts as a sophisticated signalling molecule that helps the body adapt to physical stress (Witek et al., 2017). Assessing baseline bilirubin levels in saliva and their changes after stressful situations is an innovative measure that is not currently used, as the concentrations are very low and cannot be detected by conventional analytical methods. In this work, we present preliminary results for biomarkers measured in different matrices (urine, saliva and blood) to assess the optimal analytical protocol and the matrix effect.

Bilirubin recovery test

A spike-and-recovery test was conducted, as recommended for previously untested sample types, by adding known amounts of BR to known volumes of a single pool of saliva and urine specimens, to assess potential interference from the analytical matrices. To experimentally determine the expected BR recoveries, identical spiking was performed on the solvent of the standard solution used for assay calibration, consisting of 4 g/L bovine serum albumin in phosphate-buffered saline at pH 7.4. As shown in Table 1, no significant difference in BR concentration was found between saliva, urine and the BSA solution, referred to as the observed and expected values, respectively. The low standard deviation indicates good reproducibility of the test. This data indicates that no matrix effect is present in the assay.

Table 1. Recovery of BR in blood, urine and saliva under spiking conditions.

Sample (n)	Spike Level, nM	Expected BSA	Observed	Recovery %	*p*-value
Blood (n=2)	Low	9.4 (±0.5)	9.5 (±1.4)	101	*0.309*
	Med	26.0 (±2.2)	25.8 (±3.8)	99	*0.735*
	High	46.2 (±1.6)	46.6 (±1.9)	101	*0.046*
Urine (n=2)	Low	10.3 (±0.1)	11.6 (±0.4)	112	*0.434*
	Med	24.3 (±1.0)	24.6 (±0.1)	101	*0.255*
	High	47.7 (±3.4)	48.5 (±0.6)	101	*0.192*
Saliva (n=2)	Low	10.9 (±0.1)	10.8 (±1.1)	98	*0.839*
	Med	25.7 (±1.1)	24.6 (±1.1)	96	*0.100*
	High	50.2(±0.4)	49.4 (±0.6)	98	*0.161*

n represents the number of independent replicates performed on pooled biological fluid. Results were analyzed by 2-way ANOVA test using standard significance level α = 0.05.

Quantification of BR and BRG

Figure1 shows that BR and BRG values in the blood of athlete 1 are in the same µM range and remain within physiological ranges of 11 – 21 µM and 0 – 0.7 µM, respectively. In addition, excess BR resulting from physical activity appears to be rapidly eliminated as BRG, particularly through urine and also through bile, to keep levels below toxic limits.

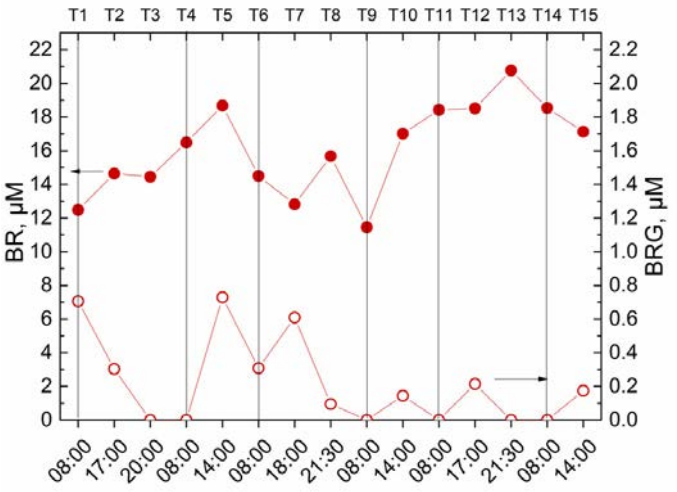


Figure 1. Bilirubin (BR) and conjugated bilirubin (BRG) concentrations in blood samples during the training week of athlete 1.

In urine, BR and BRG values are in the same nmol/g creatinine range, as shown in Figure 2A. BR and BRG in morning urine samples at 8:00 (T1, T4, T6, T9, T11, and T14) have average values of 3.4 ± 0.9 nmol/gCRE and 2.8 ± 0.7 nmol/g, respectively, as reported in Figure 2A. In contrast, these parameters show a marked increase in concentration after a training session, rising up to the 11.5 nmol/g CRE for BR and up to 6.9 nmol/g CRE for BRG (peeks in Figure 2A).

In saliva samples (Figure 2B), BR values were always higher than BRG, while in urine BRG values tended to remain in the same range as BR, consistent with BR metabolic clearance. The concentrations of BR and BRG in saliva were, on average, lower than those detected in urine without creatinine correction (data not shown), where the values were also more sensitive to variations caused by physical activity.

The peaks in Figures 2A and 2B indicate the highest values of the variables BR and BRG, occurring half an hour after training in both matrices.

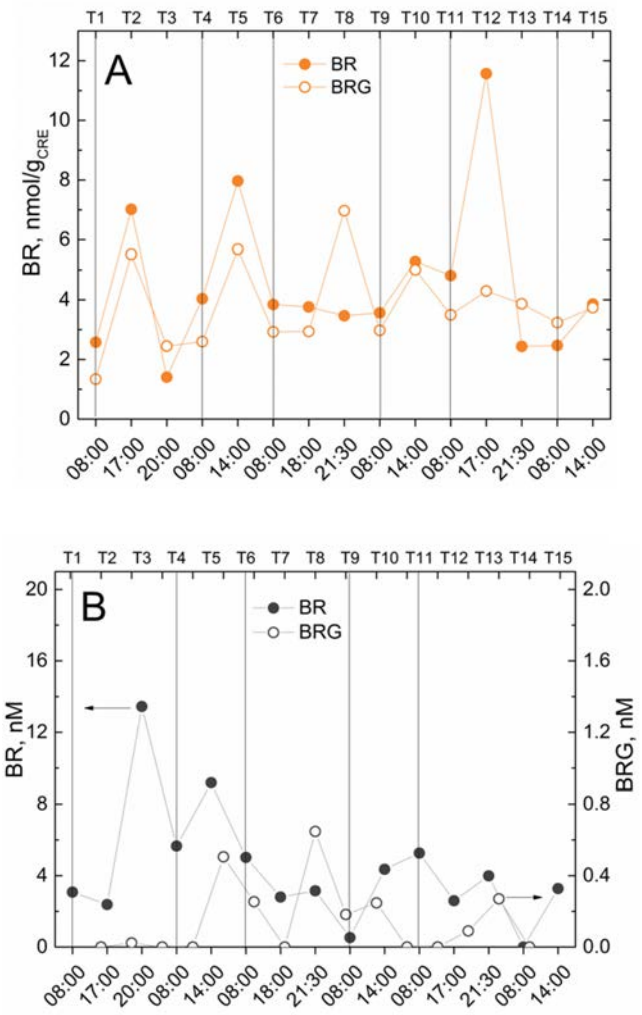


Figure 2. BR and BRG in (A) urine and (B) saliva during the training week.

Quantification of other stress biomarkers

In the present study, the biomarkers of oxidative stress — namely MDA, amylase, and cortisol — were analysed before and after training. In the previous paper (Sist & Urbani, 2022) the main findings were that aerobic and anaerobic judo training may cause a general increase in oxidative stress when the antioxidant system is inefficient in responding to free radical production.

Creatinine was also measured during the training week. While the normal reference range in adults is 0.7 – 1.4 g/L, levels in athletes are usually higher, depending on training load; therefore, specific reference values for athletes have not yet been well defined (Palacios et al., 2015). In cases of elevated creatinine concentration (>1.4 g/L), caution is advised, as high values do not necessarily indicate kidney damage. In this work, an average value of 2.9 ± 0.9 g/L of creatinine was obtained going from 1.4 g/L up to 5.2 g/L with higher values after training (3.0 - 5.2 g/L).

Salivary, urinary and blood MDA concentrations are reported in Figure 3. MDA values in urine appeared more sensitive to physical activity than those measured in blood or saliva. Therefore, in our study, urine specimens appeared to be more sensitive in the MDA monitoring assessment.

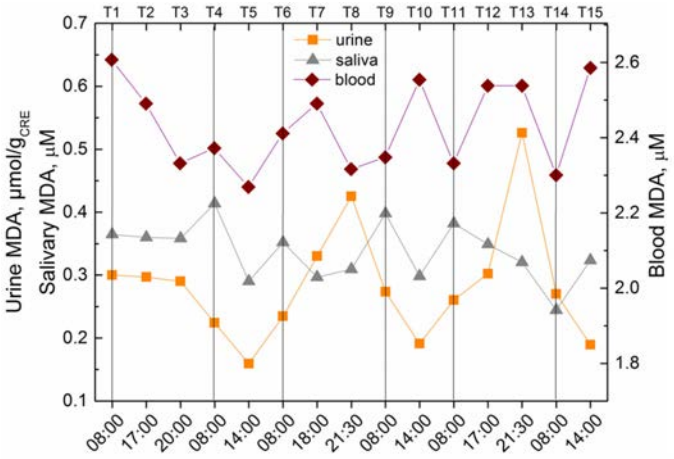


Figure 3. MDA concentrations in urine, saliva and blood during the training week.

Cortisol (CORT) and α-amylase (AA) are distinct indicators of the stress response. Their interaction is essential for understanding the effects of psychophysical stress on athletes and depends on several factors, such as training stress, intensity and the psychological response to the load. The salivary and urinary cortisol concentrations after different physical activities are reported in Figure 4A. Compared to the measurements at pre-training judo events (T1, T6, and T11), both urinary and salivary cortisol increased significantly at post-training phases T3, T7 and T13, with wide variations observed for urinary cortisol (Figure 4A). The results highlighted that high- and middle-intensity training increases the body's cortisol and α-amylase levels differently in both saliva and urine. We observed significant differences in the rates of change in cortisol concentrations resulting from early morning exercise programmes of varying intensities on different days. More precisely, greater variability is observed in urinary cortisol (Figure 4A), while conversely, greater variability is observed in salivary α-amylase (S-AA) (Figure 4B) with rapid response with marked peak values at the end of the physical exercise.

Physical exercise of moderate and high intensity caused an increase in heart rate above 100 bpm, largely due to increased sympathetic activity, which could explain the rise in the production and appearance of α-amylase in saliva after training. Much more than cortisol, which tends to remain elevated during and after peak stress, α-amylase showed a more rapid pattern, peaking immediately after a stressful event and then returning to the baseline quickly (Figure 4B). This makes α-amylase a useful indicator for detecting immediate changes in stress activation, whereas cortisol provides a more comprehensive and prolonged view of the hormonal response.

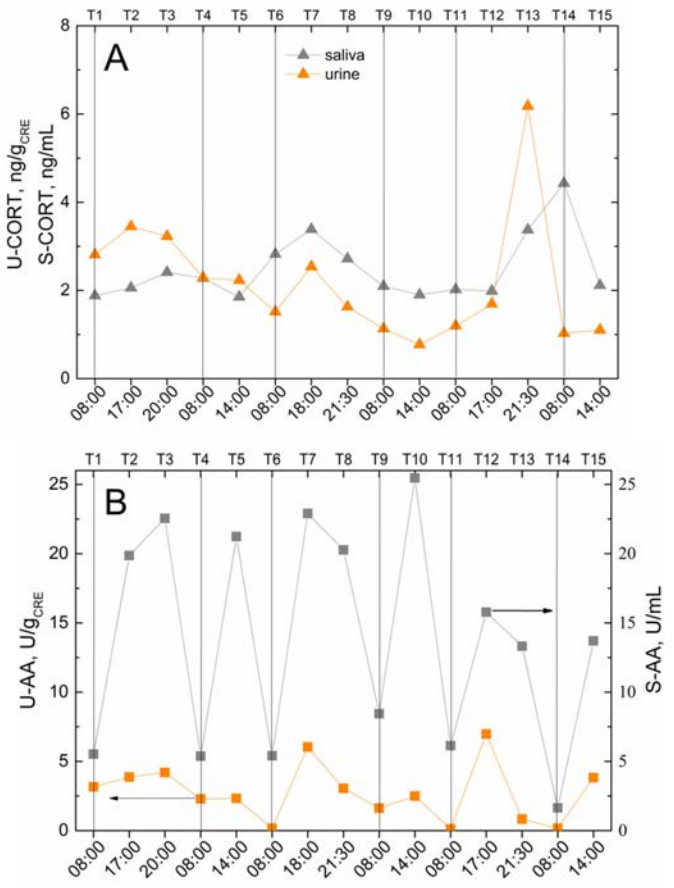


Figure 4. (A) Salivary and urinary cortisol concentrations; (B) salivary and urinary amylase concentrations during training week.

The main findings of this study confirmed that S-AA and S-CORT may provide valuable information for coaches regarding athletes' responses to training and competition. Increases in basal cortisol concentrations after periods of intensified training have already been reported in the literature and this increase markedly depends on the training status of the athlete.

Effect of competition on bilirubin level and on oxidative stress parameters

In high-intensity sports such as judo, which are characterised by explosive efforts and intense emotional pressure, competitions can generate significant physiological and psychological responses, including increased oxidative stress and psychological stress in athletes. From a psychological perspective, anticipation of competition triggers activation of the hypothalamic-pituitary-adrenal axis and increases salivary cortisol (Filaire et al., 2007), especially in the moments before competition (Salvador et al., 2003). Amylase and cortisol are complementary biomarkers of stress (Ciaccioni et al., 2024; Kivlighan & Granger, 2006; Salvador et al., 2003) and the interaction between these two biomarkers is complex, depending on several factors, including the duration and intensity of stress, the athlete's training level, and their psychological response to the load. These psychophysiological parameters (S-AA and

S-CORT), in addition to oxidative stress parameters like BR, were measured in eight athletes (2–9) during three periods (T0, T1, and T2), as schematically shown in Scheme 2.

Bilirubin is a molecule with multiple functions and has important antioxidant, anti-inflammatory and regulatory effects. Assessing baseline bilirubin levels in saliva and their changes after stressful situations could be considered an innovative measure that is not used currently, as the concentrations are very low and cannot be detected by conventional analytical methods.

Total BR (TBR as the sum of BR and BRG values) in urine was measured and the results are presented in Figure 5. Almost all the athletes showed a marked increase in TBR just before (T1) and after competition (T2) compared with T0. The number on the top of the bars in Figure 5 indicates the S-CORT concentration (ng/mL). Higher cortisol values correspond to higher TBR values.

Salivary amylase, for three male athletes (2, 3 and 4), was measured and assessed in comparison to urinary TBR and S-CORT, presented in Figure 5. S-AA (Table 2) showed a significant increase from the rest period (T0) before the competition to 1 hour before the competition (T1); then showed a trend towards a decrease after the event (Table 2), indicating higher levels of both anxiety and physical stress.

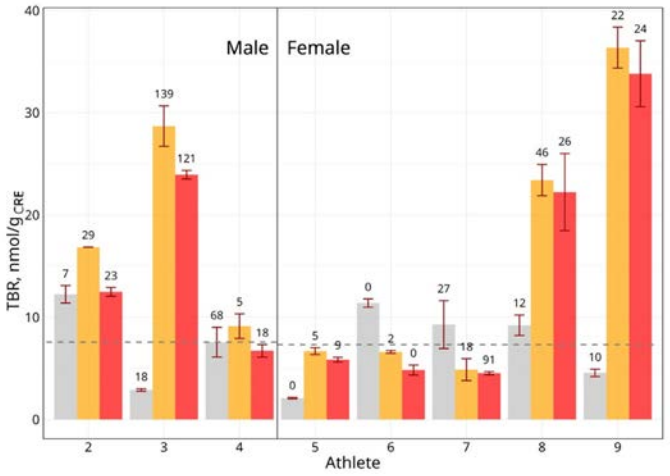


Figure 5. Total BR in urine (bars) and S-CORT values (numbers on the bars as ng/mL) of athletes before and after judo competition. (Grey bar = T0, yellow bar = T1, red bar = T2; dashed line indicates the average basal value T0 = 7.3 ± 3.7 nmol/gCRE and 7.6± 4.1 nmol/gCRE for female and male, respectively).

Meanwhile, S-CORT showed a marked increase from the rest period T0 to T1 before the competition and remained at higher levels. This increase is related to the psychophysical condition, including anxiety, which may remain higher even after the physical competition has ended. In these three subjects, the results for the three parameters differ markedly according to their varying levels of fitness and psychophysical maturity, as reported in Figure 5 and Table 2.

Table 2. Salivary amylase for athletes 2, 3 and 4 before and after judo competition

Sample	Athlete 2	Athlete 3	Athlete 4
T0	5.53	8.09	13.73
T1	9.55	9.23	28.21
T2	4.88	10.63	23.48

The present findings provide valuable information on the differences in temporary changes in stress-related parameters during real competition and training and also indicate the chronic changes that occur after intensive training in well-trained athletes. These results suggest that there may be additional correlations between psychological and physiological factors that could lead to reduced athletic performance in both competition and training. In conclusion, elevated S-AA and S-CORT levels from immediately before the competition until after its end may be factors in reduced performance.

Correlation analysis between all the parameters

All results obtained for the nine athletes were processed statistically and the Kendall correlations are presented in the matrix in Figure 6. The sample size is small and the significance obtained may be affected by this; therefore, this analysis should be considered preliminary. However, some promising correlations are highlighted to support the use of BR as an additional marker in the analysis of the oxidative status of a judo athlete. There was a positive correlation (τ= 0.283, p = 0.028) between total urinary BR (U-TBR) and total blood BR (B-TBR), suggesting that urine might reflect blood BR levels, although further validation is required. There is also a weak correlation (τ = 0.383, p = 0.059) between salivary and urinary BRG. However, as shown in Figure 2, urine values are more sensitive to metabolic changes related to sports activity.

Intense exercise can increase bilirubin levels in blood and urine temporarily, especially if muscle damage is involved (e.g., through eccentric exercise) or if there are changes in liver metabolism. However, a fairly strong correlation between U-TBR and B-TBR (blood) (= 0.283, p = 0.028) suggests that bilirubin levels may indicate how the body manages detoxification processes in both the liver and kidneys. S-CORT correlated well with urinary amylase (U-AA) (= -0.534, p<0.001), U-BR (= 0.243, p = 0.029), and U-MDA (= 0.335, p = 0.003), suggesting good correlations between psychological and physiological parameters which may lead to reduced athletic performance during both competition and training.

Cortisol is a stress hormone that rises with intense physical activity and psychological stress. If exercise is sufficiently

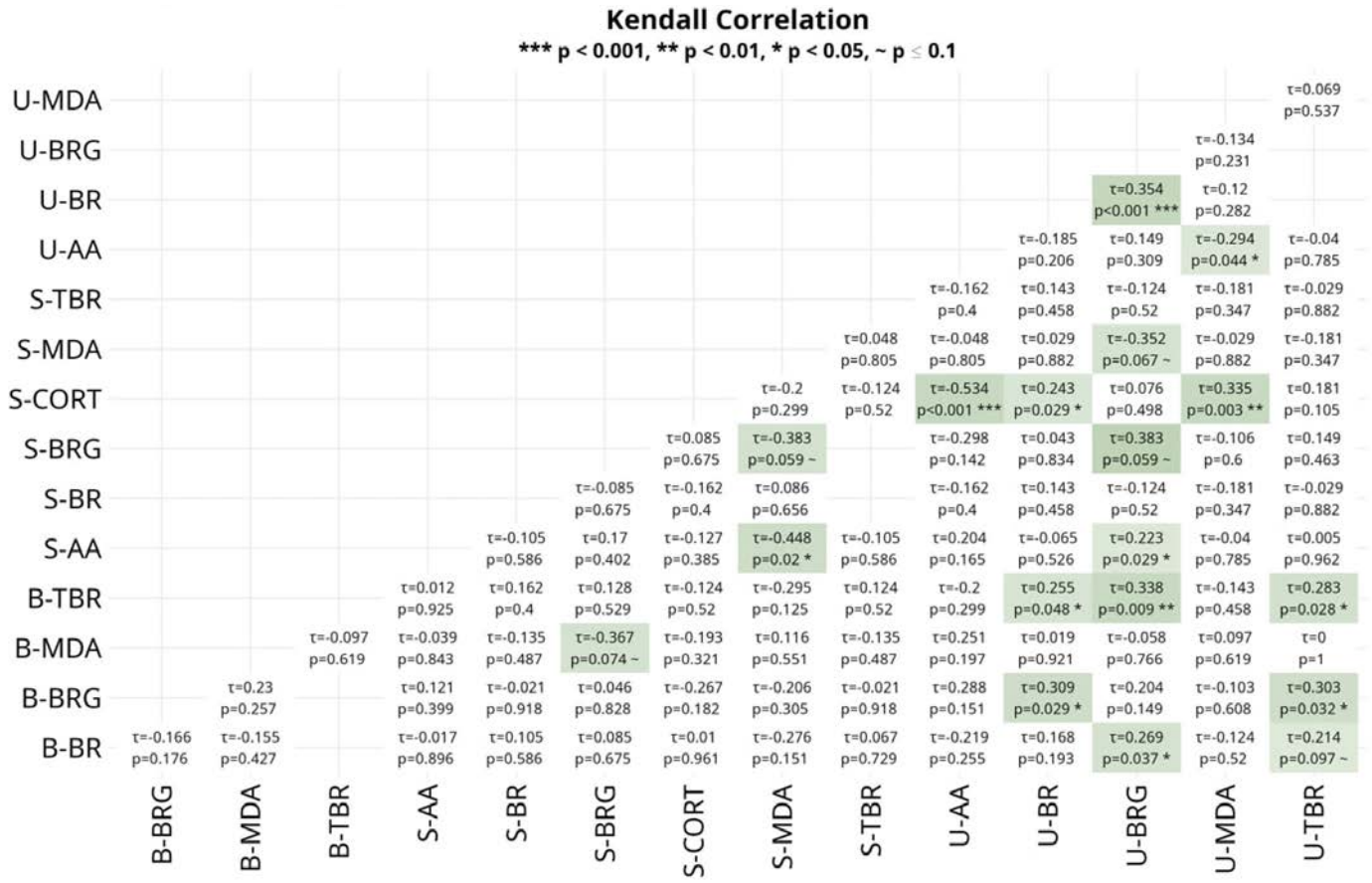


Figure 6. Kendall correlation matrix between all the parameters considered

intense to elevate cortisol, it is likely that oxidative damage and MDA production will also increase. The negative strong correlation between U-AA and S-CORT reflect a physiological response to recovery where cortisol decreases after exercise as the body enters the recovery phase. On the contrary, the increase in post-exercise cortisol may also indicate a high load on the nervous system and metabolism. If cortisol remains high, it may indicate excessive stress or insufficient recovery capacity. Moreover, increased U-AA may indicate heightened physiological stress associated with the depletion of energy resources, such as during post-exercise recovery, when the body is working to restore energy reserves. The response of biomarkers such as S-AA and U-BRG (= 0.223, p = 0.029) may indicate how the body adapts to and manages exercise. If these biomarkers are chronically elevated, it may be necessary to review the intensity and frequency of exercise sessions.

Bilirubin levels in urine, saliva and blood are generally positively correlated, which is consistent with physiological expectations. However, variables such as amylase, cortisol and malondialdehyde show weaker correlations, although there are some significant associations, such as between amylase and cortisol. Correlations with cortisol are noteworthy as they suggest possible interactions between psychophysical stress (indicated by cortisol) and bilirubin-related metabolism or detoxification processes.

Serum bilirubin levels are influenced by physiological factors described in the literature. Fasting increases unconjugated bilirubin due to reduced hepatic enzyme activity and increased enterohepatic circulation (Barrett, 1971; Fevery, 2008). The variation in bilirubin during fasting can be significantly greater in males than in females (Griffin et al., 2014). Hydration status can also cause an apparent increase in values due to haemoconcentration from reduced plasma volume (Karila et al., 2008). In addition, bilirubin concentration follows a distinct circadian rhythm, with higher inter-individual variation during the day (Larson et al., 2009), and may depend on the menstrual cycle and hormonal fluctuations (Yamaguchi et al., 1975). Considering all these factors is essential for proper interpretation of results. However, an assessment of potentially confounding factors is aided by the dietary, training and medical monitoring that elite athletes undergo.

By combining biomarkers of oxidative stress (MDA), endocrine stress (cortisol) and sympathetic response (salivary amylase) with antioxidant markers (bilirubin) in accessible matrices such as saliva and urine, it is possible to create a personalised biochemical profile to assess internal load, monitor recovery, prevent overtraining, and optimise performance.

LIMITATIONS

Despite promising results, this study has several limitations that should be considered when interpreting the results. The sample size was small (N = 9), which may limit the statistical power and generalisability of the findings. In addition, the cohort lacked sufficient diversity in

age groups, training modalities and sport disciplines (e.g., endurance versus power sports). Future research should use a larger, more heterogeneous sample and include additional psychological assessments to further clarify the relationship between bilirubin and psychophysical stress.

CONCLUSIONS

Our preliminary findings suggest that bilirubin and its derivative, bilirubin glucuronide, may act as more than simple by-products of liver metabolism, potentially serving as biomarkers in the response to oxidative stress induced by intense sporting activity, such as judo. Bilirubin, in particular, suggests notable antioxidant and anti-inflammatory properties in neutralising reactive oxygen species. Analysis of different biological matrices (blood, urine, saliva) has shown that bilirubin levels increase significantly in response to training sessions or competitions, in parallel with other biomarkers of psychophysical stress such as cortisol, amylase and malondialdehyde. In this pilot study, urine emerged as a potentially sensitive matrix for monitoring bilirubin levels, showing an increasing trend after exercise and before and after competition, probably as a protective mechanism.

The results suggest that bilirubin may be regarded not only as an indicator of liver damage but also as a marker of the body's adaptation to increased oxidative and inflammatory stress. In this context, well-trained athletes physiologically exhibit higher bilirubin levels, indicating a possible protective advantage. These findings suggest the potential for the use of bilirubin as an accessible, non-invasive and informative biomarker for monitoring health status, recovery and the risk of overtraining in athletes, supporting a more personalised and preventative approach in sports medicine.

The authors thank the FVG judo athletes, their coaches and clubs for participating in this study. The experiments comply with the current laws of the country in which they were conducted.

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EducaJudo: A Structured Judo, Neuroscience and Pedagogy Based Methodology for 3-5 Year Old Children with Evidence of Skill Transfer to Home and School

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Abstract: *The post-pandemic period has highlighted a growing need for structured pre-school methodologies capable of addressing developmental vulnerabilities in children aged 3–5 years. This study presents qualitative results from direct interviews and quantitative results of an assessment survey on attentive, emotional and behavioural skill transfer, from the dojo to the family and school environment, obtained thanks to EducaJudo. This integrated educational methodology combines judo principles, neuropsychomotor intervention and pedagogical strategies to promote holistic child development at the pre-school age. The programme was implemented across Italy in 2024, involving 291 professionals and approximately 4,000 children. Based on direct interviews, qualitative results indicate significant improvements in motor, cognitive, emotional and social domains, with particularly relevant outcomes for children with neurodivergences such as autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD). The quantitative findings from the survey to 481 parents support the effectiveness of embodied, multidisciplinary approaches to develop and transfer executive and self-regulation functions of the pre-school children into different contexts. The involved children showed an overall increased level of autonomy, respect for rules, management of emotions, attention, and self-confidence, and an increase in participation and performance in pre-school activities. These results suggest important implications for pre-school education, prevention and public health policies.*

Keywords: *pre-school age; neuropsychomotor development; judo; embodied education; autism spectrum disorder; attention deficit hyperactivity disorder*

The pre-school age (3-5 years old) represents a foundational phase in human development, during which biological maturation and environmental interaction converge to shape cognitive, emotional and behavioural trajectories. The period between the ages of three and five is particularly significant, as it is characterised by rapid advances in neuropsychomotor integration, language acquisition and socio-emotional competence. Developmental theories have consistently emphasised the centrality of embodied experience in this process. Piaget (Piaget, 1952) conceptualised early learning as rooted in sensorimotor interaction, while Vygotsky (Vygotsky, 1978) underscored the role of social engagement and guided participation in the emergence of higher cognitive functions. Contemporary neuroscience further supports these perspectives, demonstrating that early motor activity contributes to the structural and functional organisation of the brain, influencing attention, working memory and executive control (Diamond, 2000; Shonkoff and Phillips, 2000).

The COVID-19 pandemic introduced unprecedented disruptions to the developmental environments of young children. Prolonged periods of social isolation, closure of pre-school education services and restrictions on outdoor activities significantly reduced opportunities for physical movement and peer interaction. These changes not only altered daily routines but also affected the quality of caregiver-child relationships, often exacerbated by increased parental stress and economic uncertainty. Empirical studies conducted during and after the pandemic have documented a range of negative outcomes, including elevated levels of anxiety, emotional dysregulation, sleep disturbances, and delays in language and motor development (Loades et al., 2020; Patrick et al., 2020; Spinelli et al., 2020).

In Italy, national data has revealed a notable increase of 26% in five years of students with disabilities in school, amounting to 4.5% of all the students. The report indicates the prevalence of developmental disorders and learning difficulties among children in the post-pandemic period, with particular growth in diagnoses related to intellectual disabilities and psychological development disorders (ISTAT, 2024, 2023). These findings suggest that the effects of the pandemic are not transient but may have long-lasting implications for children's developmental trajectories. The persistence of these challenges underscores the urgency of implementing targeted interventions capable of mitigating developmental risks and supporting recovery.

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Because of this, the post-pandemic context has been characterised by a growing awareness among families of the importance of early physical activity, which directly translated into an increased demand for a greater attention to activities specifically created for pre-school-aged children. However, the expansion of such programmes has not always been accompanied by a corresponding evolution in pedagogical approaches. In many cases, pre-school activities continue to replicate simplified versions of adult training models, without adequately addressing the unique developmental needs of young children (Altavilla and Di Tore, 2016).

This situation calls for a redefinition of the role of sport trainers and a change in education methodology for pre-school age children. Rather than serving solely as a means of physical or technical activity development, these activities should be conceptualised as vehicles for holistic development, integrating motor, cognitive, emotional and social dimensions. Within this framework, martial arts have emerged as particularly promising due to their structured, disciplined and relational nature. Judo, in particular, offers a distinctive combination of physical engagement, rule-based interaction and ethical principles centered on mutual respect and co-operation (Harwood-Gross et al., 2021; Lakes and Hoyt, 2004). Furthermore, judo is a sport discipline that affects the motor development of children and adolescents significantly (Kowalczyk et al., 2025).

EducaJudo has been developed in response to these needs, as an integrated model that combines the educational potential of martial arts with the principles of neuropsychomotor intervention and contemporary pedagogical theories. By situating bodily experience at the centre of the learning process, the model seeks to activate the connections between the body and the brain, fostering the development of executive functions, emotional regulation and social competence. The present study aims to describe the theoretical foundations, methodological structure and empirical outcomes of the EducaJudo programme, highlighting its potential as a scalable and sustainable methodology for pre-school development.

MATERIALS AND METHODS

Development of the Methodology

The proposed EducaJudo model is grounded in an interdisciplinary framework that integrates developmental psychology, neuropsychomotor therapy, sport science and the theory of embodied cognition. This integration reflects a growing recognition within the scientific community that cognitive processes cannot be fully understood in isolation from the bodily and environmental contexts in which they are embedded. Embodied cognition posits that perception, action and cognition are deeply interconnected, with motor activity playing a crucial role in shaping mental representations and learning processes (Wilson, 2002). Within this perspective, movement is not merely an output of cognitive processes but a fundamental component of cognition itself.

The pilot programme was implemented in 2024 as part of a national initiative involving 291 professionals with diverse backgrounds, including sports instructors, educators and health practitioners. These professionals were trained in the EducaJudo methodology through a structured programme that combined theoretical instruction with practical application. The methodology was then applied with approximately 4,000 pre-school children, distributed across multiple regions in Italy. The participant group included 3-5 year old children (see Fig. 1) with typical developmental profiles as well as those presenting neurodivergences, such as autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) (see Fig. 2).

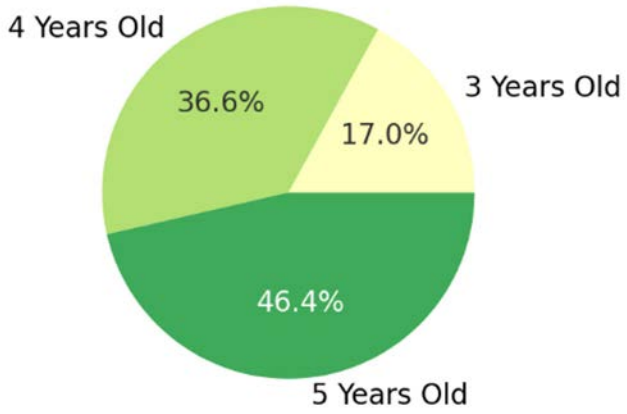

Fig. 1. Age of the children who attended one year of EducaJudo activities.

The programme was designed as a structured educational pathway consisting of two weekly sessions of forty-five minutes each. This frequency was selected based on evidence suggesting that regular but not excessive exposure to structured activity supports optimal learning and prevents cognitive overload (Diamond and Lee, 2011). Each session was organised into distinct phases, beginning with an initial moment of orientation and emotional attunement, followed by a sequence of activities targeting motor, cognitive and relational domains. The session concluded with a phase of reflection and relaxation, aimed at consolidating learning and promoting self-awareness (see Table 1).

Regarding the frequency of the programme, two weekly Educajudo sessions represent the ideal practice pace for pre-school children, ensuring continuous stimulation, motor consolidation and consistent neurofunctional development (Gabbard, 1988). A single session is insufficient to integrate body, movement and cognitive processes effectively, while three sessions risk generating fatigue, a decline in motivation and an excessive organisational burden for families (Cratty and Goldman, 1996). The optimal duration of each session is 45 minutes, as it falls

within the time frame in which children between the ages of 3 and 5 can, as they grow, maintain a good level of selective attention and adequate behavioural regulation, limiting cognitive declines and signs of neuropsychomotor hyperactivation. Empirical evidence indicates that beyond this threshold there is a progressive decline in attentional efficiency and an increase in neurophysiological fatigue (Diamond and Lee, 2011; Tomporowski et al., 2015).

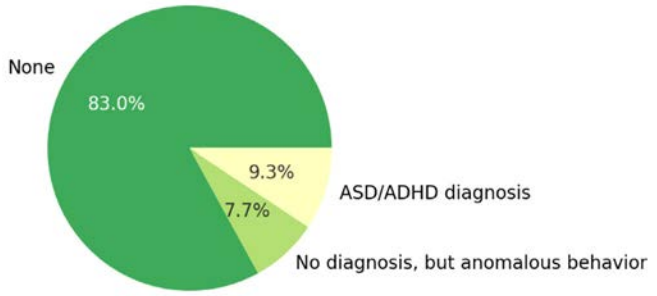

Fig. 2. Reported diagnoses of the children who attended one year of EducaJudo activities.

EducaJudo aligns with the embodied cognition paradigm that radically changed the Cartesian approach of separating mind and body, especially in education (Macrine and Fugate, 2022). In this context, cognitive tasks and all the mental and relational processes that are linked to human behaviour have a foundation in a sensorimotor system that acts as the fabric into which these processes are grafted.

This sensorimotor foundation establishes a direct link between motor and cognitive areas, particularly within the executive functions, which comprise core aspects of child learning (Diamond, 2013), including: inhibition (self-control, i.e., resisting temptations and resisting acting impulsively) and interference control (selective attention and cognitive inhibition), working memory, and cognitive flexibility (i.e., creatively thinking 'outside the box,' seeing anything from different perspectives, and quickly and flexibly adapting to changed circumstances). Body experiences, in particular complex motor activities that are embedded in the co-ordinative abilities required by judo, activate executive functions in the prefrontal cortex. Since it is demonstrated that physical activities also activate the cognitive functions (Latino and Tafuri, 2024), judo-based activities grounded in executive functions can help the child to actively accomplish both physical and cognitive learning. In particular, Kerns et al. (Kerns et al., 2001) proved that children with ADHD perform significantly below controls on measures of inhibition, attention and time reproduction. This co-regulation issue can be solved by introducing an external regulation factor in the co-operation that is established during judo partner-based activities in continual body contact.

Table 1. Programme for 45 minutes of EducaJudo activities for 3-5 year old children.

Phases	Activities
General phase / About 30 mins (70%)	Stimulation of body and sensory perception functions, body scheme, lateralisation, posture and body memory, motor schemes, co-ordination abilities, strength, endurance and speed stimuli, joint mobility and muscle tendon flexibility.
Special phase / About 10 mins (25%)	Games and preparatory exercises – stand-alone or in pairs – for the specific phase.
Specific phase / About 5 mins (5%)	Judo sparring games.

Motor activities were designed to develop fundamental movement patterns progressively, including balance, rhythm, kinesthetic differentiation and spatial orientation. These activities were embedded within playful contexts that encouraged exploration and experimentation. Cognitive tasks were integrated into movement-based exercises, requiring children to engage in dual-task situations that stimulated working memory, attention and problem-solving abilities. Mindfulness practices were introduced through simple exercises focusing on breathing, body awareness and controlled movement, supporting the development of self-regulation.

A distinctive feature of the programme was the use of controlled physical contact, derived from judo practice. This element provided opportunities for children to experience proximity, co-operation and mutual adjustment within a structured and safe environment. The relational dimension of these activities was further reinforced through group dynamics that emphasised collaboration rather than competition.

Experimental Set-up

Data collection was conducted through a multi-level assessment system. Initial information was gathered through structured interviews with parents, allowing for the reconstruction of each child's developmental history and contextual factors. During the physical activity intervention, systematic observations were recorded using standardised protocols and sessions were documented through video recordings to enable detailed analysis. Periodic assessments were conducted to evaluate progress in motor skills, executive functions and emotional expression, using both formal tasks and ecologically valid measures embedded within the activities. Throughout the programme, most of the trainers used video registrations together with a course journal (as instructed to do), thus the registered path gave most of the trainers confidence in assessing the before and after conditions to answer the final evaluation survey (see Table 2).

Table 2. EducaJudo activities for the trainers.

Timeline	Activities
10 hours	Online video lessons on the methodology, including both theory and practical videos
10 hours, in sessions of 1 hour each	Practical activities with the same group of 3-5 year old children
Throughout the course	Creation of an activity journal based on a template
10 hours	In-person workshop
-	Final exam
-	Life-long learning through the EducaJudo platform

In addition to individual-level data, a large-scale survey was conducted to capture parents' observations related to their children's development and participation in home and preschool activities. The survey provided valuable contextual information, contributing to the interpretation of the programme's outcomes within a broader framework.

RESULTS

Survey to Parents: Quantitative Analysis

The quantitative analysis of the data collected one year after the implementation of the EducaJudo programme, from 481 respondents (see Fig. 3), revealed consistent and significant improvements across several domains of development outside the sport context.

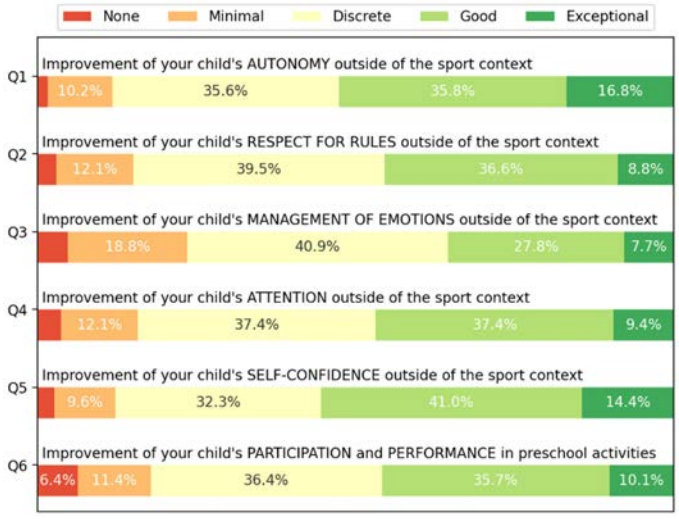

Fig. 3. Results of the survey answered by parents regarding their children's improvement outside of the sport context, after one year of EducaJudo activities.

In question Q1, the parents were asked if, outside the sport context, they had noticed an improvement in their child's INDEPENDENCE (e.g., putting away his/her shoes, getting dressed, packing his/her backpack, carrying out small tasks without help). Only 1.6% did not see any improvements, whereas 10.2% saw minimal ones, 35.6% discrete ones, 35.8% good ones, and 16.8% exceptional ones.

In question Q2, the parents were asked if, outside the sport context, they had noticed an improvement in their child's RESPECT FOR RULES (e.g., listening, obedience, kindness, respect for times, limits, etc.). Only 3% did not see any improvements, whereas 12.1% saw minimal ones, 39.5% discrete ones, 36.6% good ones, and 8.8% exceptional ones.

In question Q3, the parents were asked if, outside the sport context, they had noticed an improvement of their child's MANAGEMENT OF EMOTIONS (e.g., frustration without crisis, reduction of anger, anxiety-related aspects or excessive euphoria, etc.). In this case, a few more of them, 4.8%, did not see any improvement, whereas 12.1% saw minimal ones, 39.5% discrete ones, 36.6% good ones, and 8.8% exceptional ones.

In question Q4, the parents were asked if, outside the sport context, they had noticed an improvement in their child's ATTENTION (e.g., increased duration of games, decreased task completion time, decreased distractions, etc.). Only 3.7% did not see any improvements, whereas 12.1% saw minimal ones, 37.4% discrete ones, 37.4% good ones, and 9.4% exceptional ones.

In question Q5, the parents were asked if, outside the sport context, they had noticed an improvement of their child's SELF-CONFIDENCE (e.g., taking initiatives, trying new activities, expressing one's ideas, overcoming difficulties, not giving up, etc.). Only 2.7% did not see any improvements, whereas 9.6% saw minimal ones, 32.3% discrete ones, 41.0% good ones, and 14.4% exceptional ones.

Finally, in question Q6, the parents were asked if, in preschool activities, their children's teacher had noticed an improvement of their child's PARTICIPATION and PERFORMANCE. A small share of 6.4% did not receive feedback about any improvements, whereas 11.4% received feedback about minimal ones, 36.4% discrete ones, 35.7% good ones, and 10.1% exceptional ones.

Interviews with Parents: Qualitative Analysis

Additional qualitative results of this study were acquired from direct interviews with the parents and here they are presented in a descriptive form to give a more complete overview of the outcomes.

From a motor perspective, children demonstrated enhanced co-ordination, greater stability in postural control and increased fluency in movement execution. These improvements were evident not only in sport-related tasks, but also in spontaneous play and daily activities, suggesting a generalisation of acquired skills.

Cognitive outcomes were particularly noteworthy, with children showing measurable gains in attention span, working memory capacity and cognitive flexibility. The integration of cognitive challenges within movement-based activities appeared to facilitate the activation of executive functions, supporting the hypothesis that embodied learning can enhance higher-order cognitive processes. These findings align with previous research indicating that physical activity interventions can have a positive impact on executive functioning in young children (Tomporowski et al., 2015).

In the domain of emotional and behavioural regulation, the programme contributed to a reduction in impulsivity and an improvement in the ability to manage frustration and adapt to changing situations. Children became progressively more capable of following rules, waiting for their turn and responding appropriately to social cues. These changes were particularly evident in children who initially presented difficulties in self-regulation, suggesting that the structured environment of the programme provided a supportive context for the development of these skills.

Social development also showed significant progress, with increased levels of interaction, co-operation and empathy among participants. The use of physical contact as a medium for interaction played a central role in this process, allowing children to experience relational dynamics in a direct and embodied manner. This aspect of the programme was especially beneficial for children who exhibited social withdrawal or difficulties in peer interaction.

The outcomes of the interviews regarding children with neurodevelopmental disorders were particularly encouraging. In children with ASD, improvements were observed in eye contact, communication and responsiveness to social stimuli. The reduction of repetitive behaviours and increased tolerance to sensory input further indicated a positive impact on adaptive functioning. Similarly, children with ADHD demonstrated enhanced attention control, improved inhibitory processes and greater stability in motor behaviour.

Parental feedback provided additional support for these findings. Parents reported noticeable improvements in their children's autonomy, emotional stability and social engagement. Many expressed appreciation for the integrated nature of the programme, highlighting its ability to address multiple aspects of development simultaneously. The involvement of families in the process, through regular communication and feedback, contributed to a sense of shared responsibility and continuity between the intervention setting and the home environment.

DISCUSSION

Both the quantitative and qualitative results of this study provide compelling evidence for the effectiveness of EducaJudo as an integrated model for pre-school development. By combining elements of judo, neuropsychomotor intervention and pedagogical practice, the programme offers a comprehensive approach that addresses the multifaceted nature of development during this critical period. The observed improvements across motor, cognitive, emotional and social domains support the theoretical assumption that these dimensions are deeply interconnected and can be stimulated effectively through embodied learning experiences.

The role of physical activity in cognitive development has been documented widely, yet the specific contribution of structured, relational movement practices remains an area of ongoing research. The findings of this study suggest that the incorporation of physical contact, as facilitated by judo, may provide unique opportunities for the development of social and emotional competencies. In contrast to purely individual or non-contact activities, the relational dimension of martial arts, particularly in judo, introduces elements of co-operation, negotiation and mutual regulation that are essential for social learning.

The neuropsychomotor perspective further enriches this approach by emphasiing the importance of individualised intervention and the integration of sensory, motor and cognitive processes. This perspective is particularly relevant in inclusive settings, where children with diverse developmental profiles can benefit from tailored activities that address their specific needs while promoting participation and belonging.

The qualitative survey shows an outstanding ability of the EducaJudo methodology to transfer skills outside the sport context, where pre-school children, in particular the atypical ones, need interventions. The range of improvements spans from autonomy, respect for rules, management of emotions, attention, and self-confidence, to an overall participation and performance in pre-school activities.

Despite these strengths, this study is not without limitations. The absence of a specific control group counter-balancing the large amount of observational data collected demands future studies aimed at verifying the causal relationships indicated by the preliminary results of this study. Furthermore, the parental assessments that we collected were based on subjective observations and not objective metrics at the individual child level. We remediated this by asking several parents to make the assessment, thus making it statistically significant and objective. Future research should aim to address the collection of follow-up data at different stages of growth of the children to establish the sustainability of the observed effects.

CONCLUSIONS

EducaJudo represents a significant contribution to the field of education and neuropsychomotor intervention for 3-5 year old children in sport environments. Its integrated and embodied approach offers an effective framework for addressing the developmental challenges exacerbated by the COVID-19 pandemic, while also providing a model for future innovations in educational practice. The scalability of the programme, demonstrated through its national implementation, suggests that it has the potential to be adapted and replicated in diverse contexts.

The findings underscore the importance of rethinking pre-school interventions in light of contemporary scientific knowledge, moving beyond fragmented approaches toward holistic models that recognise the interconnectedness of body, mind and environment. By fostering collaboration between educators, families and health professionals, EducaJudo contributes to the creation of supportive ecosystems that promote the wellbeing and development of children.

The future of applied neuropsychomotor research lies in the implementation of longitudinal protocols integrating cognitive testing batteries with neurofunctional objectification through wearable EEG/fNIRS headsets, enabling the precise mapping of electrical neurocognitive profiles and neural plasticity in children during practice. This methodological evolution elevates the EducaJudo model to a fundamental pillar of public health, transforming motor activity into a powerful primary prevention tool capable of generating robust economic sustainability by reducing the social and healthcare costs associated with neurodivergence drastically.

The EducaJudo paradigm thus establishes itself as an essential scientific infrastructure in which constant technological monitoring and bio-psychosocial rigor converge to ensure lasting collective wellbeing and a modern, efficient welfare system, serving as a foundation for a new generation of educational practices that place embodied experience at the centre of learning and development.

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Judo in Preschool: A Conceptual Model of Early Educational Development Based on the Pedagogy of Jigoro Kano

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Abstract: *The growing recognition of judo as an educational system has intensified the need to reconsider its application in early childhood. Despite the increasing prevalence of judo activities for children aged 4–6 years, the preschool stage remains conceptually underdeveloped and is predominantly interpreted as either a preparatory phase for sport specialisation or as a form of general physical activity. Such interpretations limit the realisation of judo's philosophical and pedagogical potential as originally formulated by Jigoro Kano.*

The aim of this study is to conceptualise judo in preschool as an independent educational level within the system of educational judo. The research is based on a philosophical analysis of Kano's pedagogy, a comparative examination of existing approaches to pre-school judo practice and theoretical modelling.

The novelty of the study lies in the systematic conceptualisation of preschool judo as a distinct pedagogical direction, in which structured physical activity functions as a means of developing moral values, behavioural self-regulation and a culture of interaction in early childhood. The proposed model integrates the principles of Seiryoku Zenyo and Jita Kyoei with contemporary theories of child development, providing an age-appropriate educational framework.

The results contribute to bridging the conceptual gap between the recognised educational potential of judo and its implementation in early childhood. The study also establishes a foundation for the development of international methodological guidelines and a continuous educational trajectory linking preschool and school-based judo programmes.

The proposed model positions physical activity not as an end in itself, but as a pedagogical tool for developing moral and social competencies through movement, in line with the philosophy of Jigoro Kano.

Keywords: *educational judo; preschool education; moral development; Kano pedagogy; early childhood; value education*

The increasing recognition of judo as an educational system in the twenty-first century has led to a reconsideration of its philosophical and pedagogical foundations. Beyond its traditional interpretation as a sport discipline, judo is now widely understood as a structured, pedagogical practice aimed at the holistic development of the individual through physical activity. This perspective directly reflects the original concept proposed by Jigoro Kano, who viewed judo as a means of integrating physical development, moral education and social responsibility.

This study is the first to conceptualise preschool judo as an independent educational level within the structure of educational judo, thereby addressing a significant gap in existing theoretical and practical approaches.

Originally, the philosophy of judo formulated by Kano assumed the use of physical activity as a tool for the comprehensive development of the individual. The principle of *Seiryoku Zenyo* (maximum efficient use of energy) in its pedagogical dimension is associated with the development of self-regulation, conscious control of actions, and responsible behaviour. The principle of *Jita Kyoei* (mutual welfare and benefit) emphasises respectful interaction, acceptance of rules, and recognition of the value of one's partner. Together, these principles form the foundation for interpreting judo as a holistic educational system. In recent decades, there has been a steady growth of interest in judo practice at an early age. In many countries, programmes for children aged 4 - 6 years are developing as part of sports clubs, early childhood development centres, or educational programmes. Despite the growing body of research on educational judo, the preschool stage remains insufficiently theorised and lacks a coherent conceptual framework. Existing approaches predominantly reduce early judo practice to either preparatory sport training or to general physical activity, thereby neglecting its value-orientated pedagogical potential. Such interpretations narrow the potential of judo by reducing it primarily to motor preparation and leaving its philosophical and pedagogical nature in the background.

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In international practice, increasing attention is being paid to the educational potential of judo, particularly within the school environment. Research and educational initiatives, including the works of Slaviša Bradić, demonstrate the possibilities of integrating judo into school education as a tool for developing discipline, responsibility, emotional intelligence and a culture of interaction (Bradić, 2023). Contemporary studies also emphasise the role of judo as a means of values education in school settings (Gómez, 2025). International educational structures such as the International Judo Federation Academy are developing certified training programmes for coaches that cover educational, technical and age-specific aspects of judo instruction, highlighting the importance of integrating judo philosophy into systematic educational practice (Ciaccioni et al., 2024). Despite the development of educational programmes in school contexts, the preschool stage has not yet received comparable theoretical systematisation within educational judo. In the scientific literature, this stage is most often viewed either as an initial level of sports training or as a form of general physical activity. As a result, preschool judo lacks a clearly formulated pedagogical model comparable to the concepts of educational judo developed for the school environment.

Meanwhile, research in early childhood development indicates that the age of 4 - 6 years represents a sensitive period for the formation of behavioural patterns, self-control skills and models of social interaction. During this period, the foundations of children's attitudes towards rules, partners and their own actions are established. Ignoring these age-specific characteristics in the organisation of judo activities may limit the realisation of its educational potential. In recent years, studies directly examining the educational potential of judo at the preschool age have also begun to emerge. In particular, empirical findings indicate that physical activity based on the principles of judo philosophy can contribute to the development of moral attitudes, self-control and a culture of interaction among children aged 5–6 years (Krauze et al., 2025; Krauze et al., 2026). These studies demonstrate that structured motor tasks involving interaction rules, partner work and elements of self-regulation create conditions for developing respect, responsibility and the ability to follow social norms. The obtained results confirm the importance of pedagogically organised motor activity as a tool for moral development in preschool children.

Contemporary studies also show that regular judo practice may contribute to the development of cognitive functions, including attention, memory and self-regulation, confirming its significance not only as a physical but also as a developmental educational practice (Biedrzycki & Laskowski, 2024). Similar results have been obtained in studies examining the influence of judo practice on the formation of moral attitudes in preschool children, where a relationship between structured motor activity and the development of qualities such as friendship, respect, co-operation and honesty has been demonstrated. In this context, the preschool age may be considered an independent stage for the implementation of the pedagogical potential of judo. However, a comprehensive conceptualisation of this level as a structured educational direction within the system of modern educational judo remains insufficiently developed. This creates a conceptual gap between the recognised pedagogical potential of judo and its implementation in early childhood.

Despite the presence of several empirical studies examining the influence of judo practice on the development of moral qualities and social behaviour in preschool children, a theoretical model of the preschool stage as an independent level of educational judo has not yet been developed sufficiently. The present study proposes a conceptual model of ‘Judo in Preschool’ as an independent educational level within the structure of educational judo. The model is based on the pedagogical philosophy of Jigoro Kano and considers motor activity as a pedagogical means for the development of moral values, behavioural self-regulation, and a culture of interaction among preschool children. The proposed model reflects the progressive development of the pedagogical ideas of educational judo, from the philosophical principles of judo to contemporary educational practices within formal and non-formal education systems.

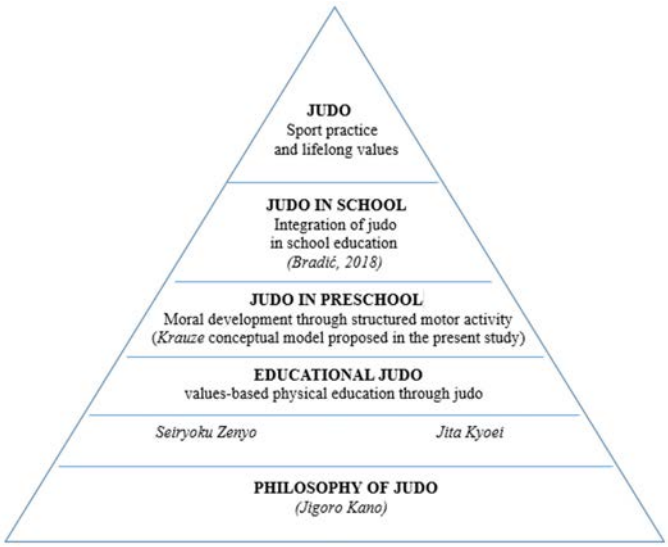

Figure 1. Educational continuum of judo from the pedagogical philosophy of Jigoro Kano to contemporary educational implementations, including Judo in School and the proposed model of Judo in Preschool.

The conceptual scheme presented in the figure illustrates the development of educational judo from the philosophical foundations formulated by Jigoro Kano to contemporary educational practices, including programmes integrating judo into school education (Judo in School). This evolution demonstrates the gradual expansion of the pedagogical potential of judo and its institutionalisation within educational environments. At the same time, the preschool stage remains relatively under-represented within this educational structure. Despite the widespread practical implementation of judo activities for young children, a comprehensive

theoretical conceptualisation of the preschool level as an independent pedagogical direction remains insufficiently developed.

The proposed model emphasises the pedagogical distinctiveness of preschool judo as a specific stage within the broader structure of educational judo, contributing to the theoretical clarification of its role in early childhood education.

The aim of this article is to theoretically substantiate the concept of 'Judo in Pre-school' as an early childhood educational programme and to define its structural characteristics within the broader system of educational judo.

The methodological foundation of the study includes a philosophical analysis of Kano's pedagogy, a comparative analysis of existing approaches to preschool judo practice, and theoretical modelling of the structure of an educational programme.

The results obtained may contribute to a more systematic understanding of the preschool stage within the structure of educational judo and may serve as a theoretical basis for further development of Judo in Preschool programmes in both educational and sport practice. In recent years, the international initiative Judo in School, initiated and theoretically substantiated in the works of Slaviša Bradić, has been developing actively. This model aims to integrate judo with the school education system and considers judo practice as a tool for fostering discipline, responsibility and a culture of interaction. Judo in School programmes are already being implemented in several countries and demonstrate the potential for the systematic integration of judo philosophy in educational environments. However, despite the development of educational initiatives at the level of school education, the preschool stage has not yet received comparable theoretical systematisation within the structure of educational judo.

Recent studies have begun to explore the educational potential of judo in preschool settings, highlighting its role in the development of moral behaviour and co-operation among young children (Krauze, 2021b; Krauze et al., 2025).

Analysis of Existing Approaches to Organising Judo Activities at the Preschool Age

An analysis of international practice and scientific publications makes it possible to identify several major approaches to organising judo activities for children aged 4 - 6 years. Despite the diversity of format and programme implementations, preschool judo is rarely considered an independent educational direction.

In the international literature, there are review publications devoted to the organisation of judo activities for children, including preschool age (4 - 6 years), which analyse recommended training duration, training frequency and safety issues. However, the main focus of these studies is placed on physical condition and motor skills rather than on pedagogical content as an educational system (Kowalczyk et al., 2022). Within the sport-preparatory approach, activities with preschool children are viewed as the initial stage of long-term athletic development. The organisation of programme content and its internal logic are aligned with the Long-Term Athlete Development (LTAD) model developed by István Balyi (Balyi et al., 2013), as well as with the developmental pathways of sport participation described in the works of Jean Côté (Côté et al., 2007).

These models assume that early childhood represents a phase of basic preparation, during which fundamental movement skills, co-ordination abilities and motivational dispositions are developed, creating the prerequisites for later specialisation. Within the LTAD framework, the preschool period corresponds to the stages "Active Start" or "FUNdamentals," where the main emphasis is placed on the development of a general motor base and on preparing the body for more systematic training loads in later stages. In the context of early judo practice, this interpretation manifests itself in the adaptation of basic elements of the discipline—*ukemi*, simplified forms of *tachi-waza*, and *ne-waza*—to the developmental capabilities of children. For example, Demiral and Şengül (2018) consider the period of 4 - 6years as the first phase of introducing a child into the system of judo education within the LTAD framework, emphasising the importance of exercises aimed at balance, spatial orientation and body control. Although value-related aspects are mentioned, the programme structure remains primarily orientated towards preparation for subsequent technical learning.

Within this approach, the main priorities typically include:

- development of co-ordination and balance skills;
- acquisition of simplified technical elements;
- development of basic motor abilities;
- preparation for more intensive training activities at school age.

It should be noted that this logic does not exclude the educational potential of judo. Review studies indicate a positive influence of judo practice on the development of cognitive functions, attention and self-regulation (Biedrzycki & Laskowski, 2024). However, within the sport-preparatory approach, these effects are generally considered secondary outcomes of the training process rather than its central educational objective. Despite the recognition of the importance of the early stage, activities with preschool children remain embedded within the logic of subsequent sport specialisation. From this perspective, their significance is defined primarily by their function as preparation for the next stage of the sport development system.

Such an interpretation limits the possibility of considering preschool judo as an autonomous educational direction with its own pedagogical purpose and internal, structural logic.

General Development Approach

In the second interpretation, judo is positioned as a form of general physical preparation aimed at developing basic motor qualities such as flexibility, strength, endurance and spatial orientation (Kowalczyk et al., 2022; Kowalczyk et al., 2023). In several programmes it is emphasised that judo practice at the preschool age forms a universal motor base that contributes to the development of co-ordination, balance and fundamental motor skills necessary for subsequent participation in various sports (Balyi et al., 2013; Kowalczyk et al., 2022; Kowalczyk et al., 2023). Within this logic, judo is viewed as a preparatory platform for the further involvement of children in other sport disciplines, including football, gymnastics, hockey and team sports. Contemporary neuropsychological research confirms that structured martial arts training, including judo, contributes to the development of mechanisms of self-regulation, social interaction and behavioural control in children (Lakes & Hoyt, 2004; Diamond & Lee, 2011; Biedrzycki & Laskowski, 2024). These effects are explained by the fact that activities requiring rule-following, movement control and interaction with a partner activate cognitive mechanisms responsible for the voluntary regulation of behaviour.

In this context, the combination of motor activity, normative structure and social interaction creates conditions for the development of self-regulation and conscious control of actions. This strengthens the argument in favour of a pedagogically organised model of Judo in Preschool, in which physical activity functions not only as a means of developing motor skills but also as a tool for shaping behavioural and social attitudes. Such an approach corresponds with theories of early motor development and contemporary perspectives on the role of physical activity in the formation of cognitive and regulatory mechanisms of behaviour (Diamond & Lee, 2011; Biedrzycki & Laskowski, 2024). However, in several existing programmes the philosophical and pedagogical content of judo is reduced to the level of general physical activity. In such interpretations, judo is considered, primarily, as a means of developing physical qualities and motor skills (Kowalczyk et al., 2022; Kowalczyk et al., 2023), while its value-orientated and educational dimensions remain insufficiently expressed.

As a result, judo partially loses its specificity as a value-orientated pedagogical practice based on the principles of Jigoro Kano's philosophy, one aimed at fostering a culture of interaction, self-control and responsibility (Kano, 1986; Bradić, 2018; Gómez, 2025).

Play-Based Approach

The third approach focuses on the use of judo elements in the form of physical games. In this case, emphasis is placed on emotional engagement, socialisation and the development of positive participation experiences. Play activity corresponds to the developmental characteristics of preschool children, supported by classical theories of cognitive and social development (Piaget, 1951; Vygotsky, 1967), according to which play represents the leading type of activity in early childhood.

Contemporary studies in martial arts and judo research emphasise the importance of play-based formats for the development of motivation, social inclusion and children's emotional wellbeing (e.g., Lakes & Hoyt, 2004; Biedrzycki & Laskowski, 2024). Analyses of educational judo programmes also demonstrate the use of game-based methods as a tool for engagement and the development of discipline (Bradić, 2018; Gómez, 2025). However, in a number of practical implementations, the play-based format functions primarily as a method for increasing children's interest in training and is not accompanied by a systematic philosophical interpretation. In such cases, the philosophical principles of judo (*Seiryoku Zenyo* and *Jita Kyoei*) are not formulated as an explicit educational framework and remain implicit.

As a result, activities may retain their developmental and socialising character but do not establish a stable educational identity or consolidate the preschool stage as an autonomous direction within the pedagogy of judo.

Limitations of Existing Approaches

The analysis of the approaches presented above shows that judo activities at the preschool age are most often interpreted either as a preparatory stage for sport specialisation or as a form of general physical activity. Within such interpretations, the pedagogical potential of judo frequently remains secondary to the objectives of physical development or subsequent sport training.

However, contemporary research around educational judo emphasises its value-orientated nature and educational potential, associated with the development of self-control, discipline and a culture of interaction (Bradić, 2023; Gómez, 2025). Empirical evidence also indicates the positive influence of judo practice on behavioural regulation and social interaction in preschool children (Biedrzycki & Laskowski, 2024). Despite the growing interest in the educational aspects of judo and the development of initiatives aimed at integrating judo with school educational environments, including Judo in School programmes, the preschool stage remains insufficiently represented in theoretical models of educational judo. This highlights the need to develop a conceptual model that considers the preschool stage as an independent pedagogical direction.

Empirical studies also confirm the potential of judo as a pedagogical tool for moral development at the preschool age. Several studies have shown that the inclusion of structured physical activities based on the principles of judo philosophy contributes to the formation of behavioural norms, self-control and a culture of interaction among children aged 5–6 years (Krauze et al., 2025; Krauze et al., 2026).

The systematisation of the identified approaches and their comparison with the proposed Judo in Preschool model are presented in Table 1.

Table 1.- Conceptual comparison of dominant approaches to preschool judo activities and the proposed Judo in Preschool model

Approach	Main Objective	Pedagogical Logic	Limitations
Sport-preparatory approach	Preparation for sport specialisation	Development of motor skills and basic techniques	Early childhood is mainly considered as a preparatory stage
General development approach	General physical development	Development of co-ordination, strength, and endurance	Lack of an explicit philosophical framework of judo
Play-based approach	Socialisation and emotional engagement	Physical games incorporating elements of judo	Value-based principles of judo remain unstructured
Judo in Preschool (proposed model)	Formation of moral attitudes and a culture of interaction	Structured motor activity based on Kano's philosophy	Requires further methodological and empirical development

Despite the presence of empirical evidence, the preschool stage remains theoretically insufficiently formalised within the system of educational judo. The absence of a clear conceptualisation leads to methodological inconsistency and fragmentation of programmes, which complicates the formation of a unified age structure within the pedagogy of judo.

Thus, the existing approaches demonstrate considerable practical diversity but do not provide a comprehensive understanding of preschool judo as an autonomous pedagogical direction within the educational philosophy of Jigoro Kano.

Philosophical Foundations of Kano's Pedagogy

The philosophy of judo formulated by Jigoro Kano originally extended beyond a narrow understanding of physical activity as a sport discipline. Kano considered judo as a pedagogical system aimed at the harmonious development of the individual through physical practice. Within this interpretation, physical action acquires an educational significance and becomes a means of character formation (Kano, 1986; Bradić, 2018).

The principle of *Seiryoku Zenyo* (maximum efficient use of energy), in its pedagogical dimension, implies the development of awareness in action, the ability for self-control and the rational distribution of effort. The principle of *Jita Kyoei* (mutual welfare and benefit) establishes a normative framework for respectful interaction, recognition of the value of one's partner and social responsibility. At the same time, recommendations for preschool judo activities presented in the review by Kowalczyk et al. (2022) focus primarily on adapting the training process to age-specific characteristics, training duration and frequency, and safety considerations. However, the pedagogical value of judo as an educational environment aimed at shaping normative behavioural patterns remains outside the central focus of the analysis.

Empirical studies confirm that judo practice contributes to the development of self-regulation and the reduction of impulsive behaviour in children, as well as to the formation of prosocial attitudes and emotional stability (Garbeloto et al., 2023). These findings strengthen the argument regarding the pedagogical potential of structured motor activity in early childhood. Similar results have been obtained in studies examining the influence of judo practice on the formation of moral attitudes among preschool children. It has been shown that structured motor activity, based on the principles of judo philosophy, contributes to the development of respect, friendship, honesty and the ability to follow social norms among children aged 5–6 years (Krauze et al., 2025; Krauze et al., 2026).

Taken together, these principles form an educational framework in which physical activity functions not as an end in itself but as a means of moral and social development. Within this perspective, judo represents an integration of physical, moral, and social dimensions of education. In preschool age, the relevance of these principles becomes particularly significant. This is also confirmed by empirical studies demonstrating that the inclusion of elements of judo philosophy within structured physical activities contributes to the development of moral qualities and behavioural regulation among preschool children (Krauze et al., 2024; Krauze et al., 2025). The age period of 4 - 6 years is characterised by the intensive formation of behavioural patterns, social attitudes and primary understanding of normative interaction. During this stage, foundations of self-regulation, rule acceptance and respectful attitudes toward others are established.

Therefore, the preschool stage may be considered not as a preparatory level of sports training but as an independent space for realising the educational potential of judo, in which Kano's philosophy receives an age-appropriate pedagogical interpretation.

Conceptualisation of *Judo in Preschool* as an Educational Direction

Based on the philosophical foundations outlined above, *Judo in Preschool* in the present study is interpreted as an independent direction within the system of contemporary educational judo, possessing its own objectives, structure and pedagogical logic.

From the perspective of the cultural-historical theory of development (Vygotsky, Cole, 1978), the formation of behavioural self-regulation and normative attitudes occurs within structured joint activity. Human development theory (Bronfenbrenner, 1979) also emphasises the role of an organised educational environment as a factor in shaping stable behavioural patterns. Within the framework of the philosophy of education (Dewey, 1938), the experience of physical interaction may be considered a space of pedagogical influence. In contrast to sport-preparatory models, where the early stage is orientated towards later specialisation, this direction focuses on the development of children's personal and social qualities within a structured educational environment.

The proposed conceptualisation is consistent with contemporary educational initiatives in judo (Bradić et al., 2023), but for the first time identifies the preschool stage as an autonomous level for the implementation of Jigoro Kano's pedagogy. It is also grounded in research examining the formation of moral attitudes among preschool children through structured motor activities based on the philosophy of judo (Krauze et al., 2025; Krauze et al., 2026).

The following definition is proposed:

Judo in Preschool is an organised educational programme of physical activity for children aged 4 - 6 years, based on the pedagogy of Jigoro Kano, aimed at the development of normative behavioural attitudes, self-regulation and a culture of interaction without focusing on sport specialisation or competitive results as an end in themselves.

This definition emphasises that physical activity is considered primarily as a pedagogical tool for shaping stable patterns of behaviour, rather than as a means of achieving sport performance outcomes. In this context, *Judo in Preschool* may be regarded as a logically preceding stage of educational judo programmes implemented in school settings, including initiatives such as Judo in School. Thus, preschool judo is interpreted as an autonomous stage of value-orientated personal development, creating the foundation for the child's later involvement in more complex forms of educational and sport judo, without being reduced to them. Defining *Judo in Preschool* as an independent educational direction implies the clear formulation of its target objectives, which provide a pedagogical interpretation of the philosophical principles of Jigoro Kano in relation to the preschool age.

The presented conceptual scheme illustrates the relationship between the philosophical principles of judo and the pedagogical organisation of motor activity at the preschool age. In this model, physical activity is viewed not as an end in itself but as a means of fostering normative behavioural attitudes, self-regulation and a culture of interaction. Through structured motor activity that includes rules, rituals, and interaction with a partner, an educational environment is created that supports the development of children's social behaviour and moral orientations.

In this context, *Judo in Preschool* may be considered a logically preceding stage of educational judo programmes implemented in school environments, including initiatives such as Judo in School (Bradić, 2018). The proposed model expands the structure of educational judo by extending the philosophical and pedagogical principles of Jigoro Kano to the early stages of child development.

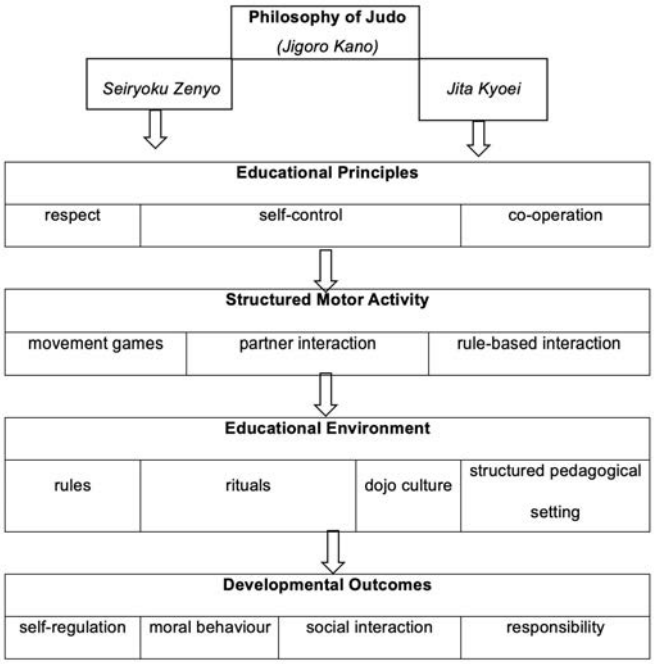

Figure 2. Conceptual framework of the *Judo in Preschool* model based on the pedagogical principles of Jigoro Kano.

Educational Objectives of the Programme

The central objective of *Judo in Preschool* is to create a pedagogically organised educational environment in which physical activity serves as a tool for developing normative behavioural patterns and social-personal qualities in preschool children.

Empirical studies on educational judo involving preschool children confirm its positive influence on behavioural regulation and social interaction. In particular, research has shown that systematic participation in judo activities contributes to the reduction of impulsivity and the strengthening of disciplinary skills, confirming the pedagogical potential of the early stage (Sterkowicz-Przybycień et al., 2014). Similar findings are presented in studies examining the formation of moral qualities among preschool children through physical activities based on the philosophy of judo, where a relationship has been demonstrated between structured motor activity and the development of respect, friendship, honesty and co-operation (Krauze et al., 2025; Krauze et al., 2026).

In contrast to sport-orientated programmes, where the primary outcomes are technical progress or competitive achievement, the present model considers physical action

as a means of developing self-regulation, rule acceptance and patterns of social interaction. From the perspective of Lev Vygotsky's cultural-historical theory, voluntary behaviour develops within socially organised activity. Consequently, motor activity acquires a developmental character only when it is embedded within a system of norms and joint actions.

Based on this understanding, the educational objectives of the programme include the following developmental directions.

Development of Self-Control and Awareness of Actions

Between the ages of 4 and 6, the development of voluntary behavioural regulation takes place. During this period, children learn to align their impulses with external requirements. Within the *Judo in Preschool* programme, this is implemented through:
• controlling the use of force during interactions;
• performing tasks in response to a signal;
• starting and stopping actions following instructions;
• maintaining an appropriate distance.

In this context, physical action becomes a mechanism for the development of internal control, rather than merely a form of spontaneous activity.

Development of Respect for the Partner and Rules

According to Jean Piaget, the understanding of rules at the preschool age develops through the practice of following them within joint activities. Within Judo in Preschool, the child:
• learns forms of greeting and concluding interaction *(rei)*;
• accepts the obligatory nature of common rules;
• learns to consider the presence of a partner;
• understands boundaries of acceptable behaviour.

Respect thus becomes not an abstract concept but a behavioural norm, reinforced through the repeated structure of training activities.

Development of Co-operation Skills and Turn-Taking

Social interaction is a key factor of development in the theory of Lev Vygotsky. Partner and group activities in *Judo in Preschool* are aimed at:
• waiting for one's turn;
• performing the role of a partner;
• providing mutual assistance;
• co-ordinating actions.

Through physical interaction, children develop the capacity for co-operation and shared responsibility.

Development of Responsibility for One's Own Actions

During the preschool years, children begin to understand the consequences of their actions. In the structured environment of judo, this is expressed through:
• understanding that excessive force may cause discomfort to a partner;
• awareness of the need to maintain an appropriate distance;
• accepting responsibility for breaking the rules.

Responsibility is developed not through punishment but through a pedagogically structured experience of the consequences of one's own actions.

Developing an Early Understanding of Fairness and Behavioural Normativity

Research on moral development (Kohlberg, 1981) indicates that early notions of fairness are formed through adherence to rules and mutual recognition. Within Judo in Preschool, this is implemented through:
• the application of the same rules to all participants;
• rotation of roles;
• prohibition of the use of force outside regulated actions;
• encouragement of correct behaviour regardless of the outcome.

Thus, the child internalises normativity as the basis of interaction.

Taken together, these developmental targets reflect an understanding of physical activity as a pedagogical instrument for the formation of personal and social qualities.

In the philosophy of Jigoro Kano, judo represents a means of the harmonious development of personality. Within the *Judo in Preschool* format, this philosophy receives an age-appropriate pedagogical interpretation: physical action becomes a means of developing self-regulation, respect and responsibility during the sensitive period of early childhood.

Structural Principles of Judo in Preschool

The development of the *Judo in Preschool* programme is based on the integration of judo philosophy and contemporary theories of early childhood development. The period between 4 and 6 years of age is characterised by the intensive development of voluntary behaviour, the emergence of self-regulation, the transition to coperative forms of interaction, and the internalisation of social norms. Research indicates that structured environments with clear rules and ritualised forms of interaction contribute significantly to the development of self-control and emotional regulation. In this context, the philosophical principles of judo and the ritual organisation of training acquire not only cultural but also neuropsychological significance (Kowalczyk et al., 2025). Based on these considerations, the programme is structured around the following principles.

Age-Appropriate Pedagogical Design

According to Jean Piaget, the preschool period corresponds to the stage of pre-operational thinking, during which children do not yet possess stable logical operations and demonstrate limited mechanisms of voluntary control. This requires the adaptation of educational content to the level of cognitive and motor maturity.

Studies on motor development show that between 4 and 6 years of age, co-ordination abilities, balance and fundamental movement patterns continue to develop, forming the foundation for the later acquisition of more complex motor actions (Karadeniz et al., 2023). Consequently, the inclusion of technically complex or potentially injurious elements (such as throwing techniques) is not consistent with developmental norms.

Within Judo in Preschool, age appropriateness is expressed through:
- the exclusion of throwing techniques and force-based elements;
- the predominance of exercises aimed at balance, spatial orientation and distance control;
- the gradual increase in task complexity through game-based activities.

Thus, the programme does not imitate a competitive sports model but is structured in accordance with the developmental patterns of early childhood.

Pedagogical Orientation of Activities

From the perspective of Lev Vygotsky's cultural-historical theory (Vygotsky, 1978), development occurs through socially organised activity within the zone of proximal development. Physical activity can serve as a means of developing voluntary behaviour and self-regulation when it is embedded in a system of rules and co-operative interaction.

Jigoro Kano viewed judo as a means of personal education, emphasising its moral dimension. In this context, each exercise in *Judo in Preschool* acquires a dual function: motor and educational (Kano, 1986; Bradić, 2018).

The practical expression of this principle includes:
- controlling the use of force during interactions;
- observing turn-taking;
- following instructions;
- completing actions in response to a signal.

Thus, physical activity becomes an instrument for the development of self-regulation and responsibility, rather than an end in itself. Empirical studies also indicate that the inclusion of structured motor tasks based on the principles of judo philosophy contributes to the development of moral qualities in preschool children, such as respect, co-operation, honesty and friendship (Krauze et al., 2025; Krauze et al., 2026).

Structured Educational Environment

Urie Bronfenbrenner's ecological theory of development (Bronfenbrenner, 1979) emphasises the role of an organised environment in the formation of stable behavioural patterns. For preschool children, predictability and consistency of structure create a sense of security and facilitate the internalisation of norms.

In Judo in Preschool, the structure of the session includes:
- a greeting ritual;
- the presentation of rules;
- a clearly defined sequence of activity stages;
- a closing ritual.

Such organisation promotes the development of behavioural normativity and reduces impulsivity. In educational models of judo described by Slaviša Bradić, discipline and respect are emphasised as system-forming elements of the training process. Thus, structure functions not merely as an organisational formality but as a pedagogical mechanism for the development of stable behavioural patterns.

Competitive Activity as an Educational Tool

In theories of moral development (e.g., Lawrence Kohlberg), it is emphasised that in early childhood the understanding of rules develops through practical experiences of interaction and the acceptance of limitations. Comparing oneself with a partner contributes to the development of self-control and the awareness of behavioural norms. Such forms of interaction are also considered important conditions for the development of moral dispositions in preschool children, including respect, honesty and co-operation within joint activities (Krauze et al., 2025; Krauze, 2020).

In the philosophy of Jigoro Kano, competition was regarded as a means of self-improvement. However, at the preschool age a formalised ranking system may shift motivation toward external recognition.

Within Judo in Preschool, the following approaches are implemented:
- game-based forms of comparison;
- co-operative tasks;
- the absence of rankings and selection procedures;
- an emphasis on correct behaviour.

Thus, the pedagogical potential of competitive interaction is preserved without premature orientation toward performance outcomes.

Practical Implementation of Philosophical Principles

The principles of *Seiryoku Zenyo* and *Jita Kyoei* are implemented through concrete forms of behaviour:
- rational distribution of effort;
- control of force;
- assisting a partner;
- respectful interaction;
- maintaining appropriate distance.

Thus, philosophy becomes part of everyday practice rather than a declarative value. This corresponds to the understanding of judo as an integrative pedagogical system, rather than exclusively a sports discipline.

Consequently, the structural principles of *Judo in Preschool* represent a synthesis of the pedagogy of Jigoro Kano and contemporary theories of early childhood development. Empirical studies confirm that pedagogically structured physical activity based on the principles of judo philosophy can contribute to the development of moral qualities in preschool children, such as respect, co-operation, honesty and friendship (Krauze, 2020; Krauze et al., 2025).

In this context, the programme creates an educational environment in which physical activity becomes a means of developing personal and social qualities during the sensitive period of early childhood.

Programme Content Components

While the structural principles define the methodological foundation of the programme, the content components reveal the practical implementation of Judo in Preschool.

Ritual–Normative Component

Greeting and closing rituals *(rei)* are traditionally regarded as an important instrument for the development of discipline and normative behaviour in judo practice (Lowry, 2006). Repeated forms of greeting and closing the session contribute to the awareness of the boundaries of the educational space, reinforce respectful attitudes and support the formation of stable patterns of interaction among participants.

Educational interpretations of judo also emphasise that the ritualised structure of training plays an important role in the development of discipline, self-control and a culture of interaction (Bradić, 2018).

This component includes:
• bows and forms of greeting;
• presentation of rules;
• the symbolic beginning and completion of the session.

The ritual functions as a mechanism for the development of internal discipline.

Motor–Co-ordination Component

The development of co-ordination, balance and spatial orientation corresponds to the developmental tasks of motor development in children (Gallahue et al., 2012). Research in judo training also highlights the importance of auxiliary exercises aimed at developing balance and co-ordination as a foundation for later technical learning (Krauze & Krauze, 2021). Contemporary research also emphasises the role of motor competence in the formation of physical activity and behavioural self-regulation (Stodden et al., 2008). In the context of judo, such motor tasks are considered an important element of early learning aimed at developing movement control and spatial interaction (Sterkowicz-Przybycień et al., 2014).

The exercises are based on:
• movements in different directions;
• balance exercises;
• distance control;
• control of interaction force.

The motor component functions as a means of developing self-control and movement awareness.

Social–Communicative Component

In accordance with Lev Vygotsky's theory of social development (Vygotsky, 1978) and Albert Bandura's social learning theory (Bandura, 1977), interaction with a partner and observation of others' behaviour are important conditions for the formation of new behavioural patterns.

The program includes:
• partner work;
• collaborative tasks;
• waiting for one's turn;
• mutual assistance.

Through bodily interaction, the child learns the norms of co-operation.

Normative–Behavioural Component

The development of early moral concepts occurs through the practice of following rules and demonstrating appropriate behaviour in joint activities (Piaget, 1932; Kohlberg, 1981). Within the training context, children:
• learn to control impulsivity;
• accept limitations;
• acquire models of fair interaction;
• become aware of the consequences of their actions.

This component links physical activity with the development of personal qualities. The exclusion of injury-prone technical elements and formal competitions is not intended to simplify the model but reflects pedagogical appropriateness and developmental characteristics of early childhood. Within a pedagogically structured physical activity environment, children have the opportunity to learn normative patterns of behaviour through action and interaction with a partner. Studies examining educational situations in judo activities with preschool children indicate that game-based formats and structured tasks can contribute to the development of respect, co-operation and other moral dispositions (Krauze, 2020; Krauze, 2021a). Thus, *Judo in Preschool* represents a holistic educational model in which the philosophy of judo receives an age-appropriate pedagogical interpretation.

DISCUSSION

The proposed model shifts the focus from performance-orientated outcomes to value-based educational processes, positioning physical activity as a pedagogical instrument rather than an end in itself. The proposed conceptualisation of *Judo in Preschool* makes it possible to reconsider the role of the preschool age within the system of contemporary educational judo. In contrast to sport-preparatory models, where the early stage is primarily viewed as the initial step to long-term athletic specialisation, the present interpretation identifies the preschool age as an independent level of pedagogical implementation of Jigoro Kano's philosophy.

A key distinction of the proposed model lies in the shift in emphasis from technical mastery and competitive performance towards the development of normative behavioural patterns and socio-personal qualities. In many existing practices, judo activities for preschool children either represent a simplified form of sports training or are transformed into general physical activity without a clearly articulated philosophical and pedagogical framework. In the proposed interpretation, physical activity is understood as a means of value-orientated personal development, while the structure of the session functions as a tool of pedagogical influence.

Research examining the educational potential of judo confirms its influence on behavioural regulation, the development of self-control and children's social adaptation (Sterkowicz-Przybycień et al., 2014). Similar conclusions have been reported in more recent studies demonstrating that judo practice can contribute to the development of prosocial behaviour, emotional stability and interaction skills (Garbeloto et al., 2023). These findings indicate that the pedagogical impact of judo extends beyond physical training and includes a significant educational dimension. Previously obtained empirical results also confirm the possibility of developing moral qualities such as respect, co-operation, honesty and friendship through structured physical activity based on the philosophy of judo.

These studies include the application of the authorial Virtue Assessment Observation Scale (VAOS), which provides a structured framework for evaluating the development of moral virtues and behavioural self-regulation in preschool children participating in judo-based educational activities. The VAOS has already been empirically tested in studies involving preschool children aged 5–6 years, demonstrating its applicability for assessing the development of core moral virtues (friendship, respect, honesty and participation) within structured educational settings based on judo philosophy (Krauze et al., 2025; Krauze et al., 2026), providing an initial empirical foundation for further cross-cultural research.

Contemporary research on educational judo also emphasises its value-orientated potential. In particular, the work of Gómez (2025) demonstrates that judo can be considered a means of developing values and social responsibility within the school educational environment. A similar direction is developed within the framework of Judo in School initiatives, theoretically substantiated by Slaviša Bradić, where judo is integrated into the school education system as a tool for developing discipline, self-regulation and a culture of interaction (Bradić, 2018; Bradić, 2023). In this context, the question arises regarding the foundations of values that are formed even before the school stage. If the influence of judo on moral and psychological mechanisms of development has been demonstrated for school-age children (Bradić, 2023), it becomes logical to consider the preschool period as the stage at which basic behavioural dispositions are formed, upon which the educational model of school judo can be built subsequently.

A number of studies also indicate that judo practice may contribute to the development of cognitive processes, including attention, executive functions and self-regulation (Biedrzycki & Laskowski, 2024). These findings strengthen the argument for the importance of pedagogically structured physical activity during the sensitive period of early childhood. Empirical studies focusing on the development of moral qualities in preschool children within judo activities demonstrate that structured motor activity may contribute to the formation of values such as respect, co-operation, honesty and friendship (Krauze, 2021b; Krauze et al., 2025; Krauze et al., 2026). These findings confirm that the philosophical principles *Seiryoku Zenyo* and *Jita Kyoei*, formulated by Jigoro Kano, can be implemented not only within sport practice but also within the educational environment of the preschool age.

It is important to emphasise that *Judo in Preschool* does not oppose existing educational judo initiatives, including Judo in School programmes. On the contrary, the proposed model can be considered a structurally preceding stage within a unified age-based system of educational judo, forming the behavioural and value foundation for the subsequent inclusion of children in school and later educational programmes. At the same time, the absence of formal competitions and ranking systems in preschool activities does not imply the rejection of comparative elements. Within the *Judo in Preschool* programme, such elements are implemented in a game-based form and are primarily aimed at developing self-control, rule compliance and respectful interaction among children.

Existing academic reviews also indicate that judo practice can begin as early as 4 - 6years of age, with recommendations regarding the duration and frequency of training sessions (Kowalczyk et al., 2022). However, despite the growing interest in this age group, a coherent pedagogical model of preschool judo integrated into a system of educational judo has not yet been articulated clearly. Thus, the proposed conceptual model of *Judo in Preschool* expands the framework of contemporary educational judo by introducing the preschool stage as an independent and conceptually structured level. This makes it possible to move beyond reducing early judo practice to a preparatory stage of sports training and instead consider it an autonomous educational practice aimed at the development of moral and social qualities in children.

At the same time, it should be noted that the present study is primarily conceptual and theoretical in nature. Further empirical research is necessary to evaluate the effectiveness of the proposed model in different educational environments and cultural contexts.

Practical and International Implications

The proposed concept of *Judo in Preschool* has significance not only for a theoretical understanding of the preschool stage but also for the practical organisation of educational judo programmes in an international context. Firstly, the systematisation of the preschool direction makes it possible to establish common value-orientated guidelines for working with children aged 4 - 6 years. This contributes to reducing methodological fragmentation and prevents the reduction of activities either to early sport specialisation or to general physical activity without a clear philosophical foundation.

Secondly, defining *Judo in Preschool* as an independent level creates a basis for continuity between preschool, school and subsequent stages of educational judo. In this context, the preschool stage can be viewed as a value and behavioural foundation for children's further participation in educational judo programmes, including initiatives such as Judo in School (Bradić, 2023). Third, the development of international methodological guidelines for *Judo in Preschool* could include the definition of value priorities, age-appropriate pedagogical principles, requirements for the educational environment, and recommendations for the training of specialists.

Existing international educational initiatives, including the specialist training programmes of the IJF Academy, provide an institutional platform for the development of such guidelines and for integrating the preschool stage into the broader system of educational judo.

Limitations of the Study

This study is theoretical in nature. Although initial empirical studies using structured pedagogical observation have demonstrated the applicability of the proposed model in preschool settings, further research is needed to expand the evidence base across different educational contexts and cultural environments. In addition, the implementation of the model may vary depending on institutional conditions, pedagogical approaches and the professional preparation of coach-educators.

CONCLUSION

This study presents a model of *Judo in Preschool* as an independent level within a system of educational judo. It expands the existing understanding of educational judo by introducing the preschool stage as a structured and pedagogically organised level of practice. In contrast to sport-preparatory approaches, the proposed model focuses on the development of behavioural patterns and social qualities in early childhood. This allows early judo practice to be seen not as preparation for sport, but as an educational space in which motor activity serves as a means of developing moral and social competencies, in accordance with the pedagogical principles of Jigoro Kano.

The analysis of philosophical foundations, contemporary educational theories and existing research on the pedagogical effects of judo demonstrates that structured physical activity based on the principles of *Seiryoku Zenyo* and *Jita Kyoei* can contribute to the development of self-regulation, respect, co-operation and other moral dispositions in preschool children.

The proposed model also highlights the importance of the preschool stage as a value-forming and behavioural foundation for later participation in educational judo programmes, including school-based initiatives such as Judo in School. In this context, *Judo in Preschool* may serve as the initial stage of a continuous educational trajectory within the broader system of educational judo. The continuity between preschool and school stages has already been discussed in the literature on educational judo, particularly in relation to Judo in School programmes (Bradić, 2018; 2023), which supports the relevance of analysing value formation at the preschool level. As the present study is conceptual in nature, further empirical research may contribute to validating the proposed model across different educational environments and cultural contexts.

The conceptualisation of *Judo in Preschool* presented in this study expands the framework of contemporary educational judo by introducing the preschool stage as a pedagogically structured and philosophically grounded level of practice.

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Judo and Women: The End of Invisibility?
Critical Issues in the History of French Judo

By Michel Brousse

Abstract: *This article explores the history of women's judo by situating it at the intersection of gender-power relations, cultural transfers between Japan and France, and the transformations of modern sport. Rather than a simple 'delay' represented by replicating the male model or a linear transfer of Japanese judo, the development of women's judo appears as the outcome of compromises, conflicts and enduring negotiations over the legitimacy of women's presence on the tatami. Exploring federation archives, the press, biographical sources and programmatic texts, the study distinguishes two main periods. The 'pioneers' time,' from the Kodokan to the French implantation, highlights the disciplining of female bodies and the competition between Japanese and French models. The 'athletes' time,' from international sportification to the inclusion of women's judo in the Olympic programme, shows how the boundaries of respectability, performance and sporting citizenship were redrawn. The French case is analysed as a laboratory for the 'de-Kodokanisation' of women's judo and of the reconfiguration of power hierarchies, where market logic, federation policies and women's agency intersect.*

Keywords: *women's judo; sport history; gender and power relations; cultural transfers; Olympic Games*

Today, Romane Dicko is one of the leading figures in contemporary judo. Several times a world and Olympic medallist, she has become a role model for young people and for French judo, yet her success is also unsettling. On social media, disparaging comments and insults have been directed at her. These sexist and fatphobic attacks, targeting her body, her demeanour and her legitimacy, reveal the persistence of implicit norms of masculinity in a sport that is nevertheless highly committed to gender equality.

This emblematic case raises a broad set of questions. Is judo one of those "men's sports" described as a masculine stronghold and a "male preserve"? (Elias & Dunning, 2008). Should its practice be seen as having been historically organised to reproduce male domination and women's marginalisation? Which influences and drivers of change have successively shaped the acceptance, recognition and eventual celebration of women? What does the history of women's judo tell us about how gender boundaries are negotiated, shifted or recomposed within a sport that is presented both as a Japanese martial art and as an Olympic discipline governed according to the political model of Western sport?

A preliminary point must be addressed. Strictly speaking, there is no such thing as "women's judo," as opposed to "men's judo," either in training or in competition. Neither current regulations nor modes of opposition distinguish a specifically masculine or feminine practice. Unlike other sports, such as tennis or athletics, men and women compete under identical conditions, governed by the same rules, the same procedures and the same number of weight categories. The only formal difference lies in the obligation for women to wear a white T-shirt under the *judogi* jacket.

Judo is a human activity that claims a Japanese origin. It is a cultural product which, by virtue of its exportation and subsequent entrenchment outside Japan, requires an analytical framework suited to the transformations it has undergone and the modes of circulation it has followed. The deliberately culturalist approach adopted in this study justifies drawing on theoretical models from the sociology, history and anthropology of sport that have examined gender relationships in sport, as well as the circulation and hybridisation of cultural forms. Elias and Dunning, Hargreaves and Pfister, and Appadurai will thus be mobilised as the analysis unfolds. Like modern sport, a product of industrial British society, judo was born in the city. Kano's method is not a traditional martial art; it is a product of the Meiji Restoration and the construction of a nation state that reorganised Japanese society profoundly and assigned specific roles to men and women. Jigoro Kano's work cannot be understood independently of the upheavals and political choices of this period.

The history of women's judo has been the subject of several studies documenting the opening of practice to women and the effects of internationalisation (Mizoguchi, 2011; Yamaguchi, 2012; Callan-Spenn et al., 2019). These works shed light on historical sequences and pioneering figures. The history of women's judo, in Japan as well as in the West, relies on primary sources that are now well identified, supplemented by a large body of secondary sources that must nevertheless be treated with critical distance. While the empirical richness of this corpus is

undeniable, its use often fails to avoid the autotelic risk of hagiographic narratives that focus more on celebrating women's judo and its pioneers than on offering a systematic analysis of the power relationships and gender issues that structure these trajectories.

This observation invites a return to Jigoro Kano's project itself, the ambivalence of which sheds light on subsequent tensions. As early as 1893, the founder of judo allowed young women to attend his classes. From November 1923 onwards, regular teaching was introduced. Three years later, an official women's section, the *joshi bu*, was created. In 1933, when the Kodokan was rebuilt, a dojo was reserved for the women's section (Maruyama, 1939; Fukuda, 1973; Teizo et al., 1978; Miarka et al., 2011). Should judo therefore be regarded as an instrument of emancipation for Japanese women? How should the originality of Kano's approach be assessed in relation to women's practice of martial arts and physical education before and during the Meiji Restoration? Was the practice offered to the students of the *joshi bu* freed from the conformist constraints imposed at the time by Japanese society?

In Sporting Females, Jennifer Hargreaves describes sport as a field of struggle for control over the female body (Hargreaves, 1994). Her socio-historical study shows how gender relationships are constitutive of power relationships. Hargreaves places women at the centre of the analysis and insists on the paradoxical nature of women's sport, but outside Japan, how should we understand the role of women's judo? The export of Kano's method to the West involves a process of cultural transfer that complicates the issue. Has Kano's method functioned primarily as a site for reproducing hierarchies of gender, class and race or has it acquired genuine emancipatory power by granting access to new resources and identities? Hargreaves' perspective helps us grasp women's trajectories in the world of judo not as a linear progressive narrative, but as a succession of compromises in which equal opportunities remain constrained by dominant masculine norms.

From a transnational perspective, women's judo cannot be analysed without distinguishing periods, places, actors and institutions. Historical inquiry must therefore incorporate the differences revealed by a comparative approach. In Gender and Sport: Changes and Challenges, Pfister and Sisjord outline an international panorama of inequalities and power dynamics that shape sporting practices (Pfister & Sisjord, 2013). Sport appears here as a space where gender identities are produced and transformed, through questions of participation, governance and sexual and symbolic violence, rather than as a mere arena for the application of pre-existing norms.

Because of its singular trajectory, French judo provides a paradigmatic case. Under the influence of Mikinosuke Kawaishi, an itinerant expert who settled in Paris in 1935, the French model positioned itself as a competitor for Japanese judo (Brousse, 2005). While they remained respectful and admiring, French leaders nevertheless asserted their independence from the Japanese system, buoyed by the success of national development and the international influence of French judo. This specific context makes it possible to reconsider the modes of access and recognition of women *judoka* by questioning practice, official discourse and the reproduction of gender hierarchy.

Once regarded as marginal, women's judo has now gained full recognition. Despite the obstacles encountered, its development has been rapid and distinctive. It can be read as a broad process of cultural transfer in which a Japanese invention is progressively translated, reinterpreted and institutionalised by a plurality of actors: Japanese masters, Western pioneers, national federations and international bodies (Espagne, 1999). Opened to competition, women's judo became, with its inclusion in the Olympic programme at the Seoul Games in 1988 (as a demonstration sport, before its core inclusion in 1992), an emblem of a hybrid sporting culture, combining educational values, European federative logics and Olympic high-performance norms. From Arjun Appadurai's perspective, this trajectory is part of the broader movement of globalisation, characterised by multiple scapes: the circulation of people and ideas, and the growing importance of media and funding regimes (Appadurai, 1996). Women *judoka*, from Japan to Europe and other continents, thus emerge as key actors in these flows. They appropriate the Japanese martial art, transform it into a universal Olympic discipline and, in return, reshape the place of women in judo, as illustrated by the international success and media visibility of contemporary champions in Japan itself and in many countries.

Adopting a comparative cultural history perspective, this article examines the development of women's judo from Japan to France and then at a transnational scale. The evolution is approached from a double perspective: first, through the concept of the progressive 'de-Kodokanisation' of women's judo, understood as a distancing from the original model via the imposition of new norms of performance, sporting femininity and governance, and second, through the internal reconfiguration of power relationships between men and women within federations, clubs and training spaces. Often described as emancipatory in principle but conformist in its modalities, Kano's legacy is continuously reworked amid innovation, resistance and compromise.

The analysis is structured in two phases. The first runs from the founding of the Kodokan school in the early 1880s to the late 1960s. It examines the initial Japanese project in Japan and in France. It brings to light the 'pioneers' era' and reveals multiple discrepancies, advances and setbacks arising from the succession of dominant concepts, linked both to the manner in which the Japanese method took root in France and to shifting views of women's judo. The 'athletes' era' corresponds to the second phase, from

the 1970s to the present day. Investigating the drivers of change reveals a rapid yet arduous conquest, shaped by strong personal commitments and a questioning of norms and cultural references inherited from the global expansion of judo (Brousse, 2015). Finally, by extending the analysis to the most recent controversies, the focus moves beyond the French case alone to address the 'battles to come' for women's judo.

The time of the pioneers (from the late nineteenth century to the 1960s)

Jigoro Kano, women's judo and the nation-state

In Japan, the opening of judo to women must be understood within the ideological context of a nation-state building characteristic of the Meiji Restoration. The maxim '*ryosai kenbo*' (good wife, wise mother), encapsulated the political framework for physical education designed for Japanese women regarded as paragons of health and models of discreet, controlled femininity (Ikeda, 2010). When, in 1893, Kano authorised his student Tomita to teach the Kodokan method to Sueko Ashiya and her friends, he took a considered decision. Tomita recalled, "Master Kano did not give his consent immediately, but informed us that he would discuss our request with his wife" (Kodokan, 2009, p. 129). Kano was then thirty-three years old; his wife, the daughter of a diplomat and distinguished Sinologist, was twenty-one. She joined the group and practised judo with her friends. The familial, social and intellectual environment surrounding Kano helps to explain his affirmative response. The support he later gave to Noriko Yasuda followed the same logic. Concerned about the extremely fragile health of this young woman, he devised a gradual programme of physical exercises that included judo. The positive results encouraged him to pursue this endeavour and to create a section for women. Judo was placed at the service of the nation state, as Kano made explicit in his 1916 article 'The Japanese people and judo' "I wrote this text in the conviction that the spiritual education provided by judo would be the best way to heal the nation" (Maruyama, 1939, p. 256). The goal Kano set himself justified offering differentiated training content in order to develop the qualities and skills expected of each gender.

A member of the International Olympic Committee since 1909, Kano attended the Stockholm Games in 1912. His numerous contacts and travels within an Olympic movement, then largely hostile to women's participation, helped shape his view of women's sport. Roles were clearly and firmly compartmentalized, "In future, I want to spread throughout Japan a system of physical education for the people which ensures that children remain children, adults remain adults and women remain women; a system which reaches all groups and, while they practise it, improves their bodies, greatly develops civic spirit and also cultivates refined interests" (Kano, 1938, cited in Cadot, 2006, p. 388). "Making women, women" meant producing a femininity conformed to the prevailing gender order, in the service of the nation. In France, at the same time, the formula was scarcely different, "Strong women make strong races" (Tissié, 1919).

The creation of a women's section inside the Kodokan was an innovation that must be resituated in its historical context and linked to the nationalist views that the founder of judo did not hesitate to proclaim, "The prosperity of a country depends on the fullness of the nation's energy, which in turn is inseparably linked with the efficient training of the people's mind and body. Hence all the Powers of the world are busy trying every means to enhance their national strength. With this end in view they devote, inter alia, their unstinted efforts to physical culture, and there is no country but has some methods characteristically its own, with which it endeavours to foster the national vigours" (Arima, 1908).

Although Kano's approach was unprecedented, the prohibition of competition, the centrality of *kata* in teaching, the limitation of intensive *randori* and the restriction of contact with men were explicitly legitimised by an ideology of restraint and respectability that reaffirmed dominant gender norms (Kietlinsky, 2011). Admission to the Kodokan was more restrictive for women than for men. For reasons of prudence and respectability, Kano required a medical examination, a certified copy of the family register and a formal application form (Yamaguchi, 2012, p. 55). He signalled the difference in practice by the addition of a white stripe on the black belt. This distinctive marking symbolised the incompleteness of a rank for which effectiveness was both not sought and deemed inappropriate (Mizoguchi, 2021).

Founded in 1895 in Kyoto, the Dai Nippon Butokukai (Greater Japan Martial Virtue Society) was a state-sponsored association created to preserve and disseminate the martial arts, including judo. Far from being a mere, passive relay of government policy, the masters who composed it developed their own nationalist orientation (Gainty, 2017). Important differences separated its outlook from that of the Kodokan, in particular with regard to the militarisation of bodies and the exaltation of national virtue (Nakajima, 2016). Divergences also extended to women's judo. Mizoguchi cites several newspaper articles revealing that women's competitions were organised as spectacles in schools outside the Kodokan. She notes, "However, in other judo and jujutsu schools, women not only took part in competitions and *randori* with men, they also had female instructors and even ran their own dojo" (Mizoguchi, 2013). The few surviving photographs from the period show that women graded by the Butokukai wore a black belt identical to that of men. Mizoguchi further recalls that the Butokukai authorised mixed-gender grading contests. In the Butokukai's teaching of judo, the militarisation of bodies tended to erase the difference between the sexes (Mizoguchi, 2013). At the Kodokan *joshi bu*, judo bore little resemblance to a martial art. The physical exercises prescribed there were expected to remain measured, aesthetic and controlled. They formed part of a project orientated towards family and nation, rather than towards individual emancipation, and even less towards a warrior ideal. The rationale was scientific and medical, but it was also moral,

"In all things one must respect the path of hygiene. By breathing pure air, exposing oneself to sunlight, avoiding harmful bacteria and building up resistance to cold and heat, one must indeed strive to protect oneself adequately against extreme temperatures that are hard to bear, but above all one must avoid falling into the traps of alcohol, lust and gluttony" (Kano, 1918, cited in Cadot, 2006, p. 441).

Kano's thinking evolved following his co-optation by the international Olympic movement. His ambition to train a youth useful to the nation now incorporated moral principles of self-cultivation, mutual aid and mutual prosperity, which would become foundational to the image of the discipline outside Japan (Niehaus, 2019). Kodokan judo was conceived as a distinctive practice. The first pupils were drawn from secondary schools and higher education institutions. They came from families that could support long studies leading to careers in the army, the civil service or teaching. Their conduct was governed, in Bourdieusian terms, by what may be called a class habitus. The resulting gender hierarchy thus established at the very outset of women's practice of judo refers back to stereotypes that form a social mythology, that is, "historical schemes of perception and appreciation which are the product of the objective division into classes (age classes, sex classes, social classes) and which operate below the level of consciousness and discourse" (Bourdieu, 1979, p. 546). In Japan, in the school sphere, the teaching of bodily exercises long remained dedicated to reproducing gender relationships (Manzenreiter, 2007). It was only from 1989 onwards that middle- and high-school girls were allowed to choose a sporting activity freely as part of their curriculum.

Mikinosuke Kawaishi and cultural transfer

In the late 1930s, after a period of indifference, Japanese martial arts attracted attention in France once again, now enriched by the educational dimension so dear to Kano. In the press, sensation and invincibility gave way to the laws of physics and balance. Moshe Feldenkrais was the true pioneer of Kano's method in France. The dojo he ran in Paris, in the Latin Quarter, was attended mainly by students from the Institut du Radium, the Collège de France, the Sorbonne and the Grandes Écoles. The socially unsettling image of physical confrontation was overturned. Newspapers now presented a science, a school of self-control and a sure means of refining both character and body.

Judo forged both minds and bodies and soon established itself as the most effective, but also the most cultivated and intellectualised of the combat disciplines. A cultural and intellectual elitism took shape, rooted in the unions of thought and action, intelligence and efficiency. The pursuit of elegance in performance did not exclude women's participation; on the contrary, it encouraged it. The female pioneers were driven by their taste for physical exercise and by the sense of autonomy that practice afforded them. Yet in most cases they could only train within socially acceptable settings and under the protection of a brother or a husband.

The arrival of Mikinosuke Kawaishi in France gave this process a new direction. A travelling expert, he had acquired first-hand experience during his stays in the West. The United States, Brazil and England had taught him how keenly those who wished to penetrate the mysteries of the Orient valued such knowledge. Many judo globetrotters were inspired by the success of the famous Mitsuyo Maeda, 'Count Koma' (Bunasawa, 2019). Admiring his exploits, they rode the wave of invincibility that the Japanese method then seemed to guarantee. True cultural brokers, these experts travelled the world as professionals of combat and spectacle. To their accustomed feats they added exoticism and mystery. The stories of their travels sparked vocations. Ishiguro Keishichi, a renowned *judoka* and essayist, was one of them. He recalled, "Around 1915, The World of Adventure, a popular magazine, published the accounts of Mr Maeda and his judo adventures around the world. We were all fascinated." In his memoirs, the man who went on to promote judo in many countries during the 1920s and 1930s wrote, "I left Japan with one suitcase. When I came back, I had thirty-five" (Ishiguro, 1953). This anecdote conveys the interest shown in specialists of Japanese martial arts. It also illustrates the social prestige, honour and financial rewards that a young generation, confronted with the grave economic problems of a country partly devastated by the Great Kanto earthquake of 1923, could hope to attain.

Kawaishi was born in Himeji in the Kansai region, where judo was under the influence of the Butokukai rather than the Kodokan. In 1926, armed with a degree from Waseda University, Ishiguro's alma mater, and holding a fourth-dan black belt, he fulfilled his ambition to discover the Western world. San Diego, New York, São Paulo and London were the stages that finally led him to Paris in 1935. Over the course of this long odyssey, he devised an effective way of capitalising on his undeniable skills. Upon his arrival in France, he set up an economic system based on a network of branch dojos, which quickly became a model. In 1955, a protectionist law consolidated this system by requiring anyone wishing to teach judo professionally in France to hold a state-recognised qualification. France thus became the first country in the world to regulate the teaching of judo on a professional basis. The black belt conferred the title of instructor and opened up attractive earning prospects. Classes, membership fees and public demonstrations provided reliable income for those who settled in urban areas. In this context, opening the tatami to a broader public responded to a market logic, supported strongly by extensive advertising and the resolutely proselytising attitude of French judo instructors.

In the choreographed street-fight scene that concluded each of the many public events organised in major cities, a young woman would distinguish herself by throwing several assailants. Judo thus displayed and staged the sen-

sational and the marvellous. Success was guaranteed. The clientele had no gender; anyone who could pay their fees was welcome, provided they complied with the strict framework of customs and norms that the masters sought to preserve. This specifically French configuration shows that opening dojos to women did not stem from a shift in ideology in favour of emancipation but from a process that must be described above all as commercial.

Kawaishi went further. In May 1950, he launched an original initiative: the first women's competition, open to "ladies holding the orange belt." On 5th November 1950, at the Lyon Gala, Jeannine Levannier, a brown belt, defeated four men in straight-line competition in 1 minute and 5 seconds. Jeannine Levannier thus became the first French woman to be awarded a black belt.

Kawaishi's avant-garde stance must be related to his trajectory in the West. When he arrived in Paris, he quickly came into contact with the student and Parisian elite training under Moshe Feldenkrais. Freed from the aristocratic model cultivated by Koizumi at the Budokwai in London, Kawaishi was free to commercialise the teaching of his art (Bowen, 2011). He became a leading figure for the first generation of French judo officials.

Returning to the Kodokan model

In France, in the aftermath of the Second World War, the number of women practising judo was very small, fewer than a hundred. Kawaishi's initiative was essentially a publicity move aimed at women (and would be continued in Morocco until 1955) but it had little overall impact. On the one hand, male reactions remained cautious, as it would have been unwise to contradict the Master. On the other hand, Kawaishi's dominance was coming to an end. The arrival in France of Ichiro Abe in late 1951 triggered strong opposition to the authoritarian system then in place and led to political change within the federation. In this new internal climate, preference shifted to the Kodokan, seen as a sign of renewal. Women's judo began to conform to the prevailing view that still held sway in Japan in the 1950s. The arguments drew on social norms and medical opinion once again. In May 1957, the federation's medical officer, J.-M. Ficheux, set out the new official position, signalling a return to conservatism. Relying on his scientific authority, the federation's doctor invoked a seventeenth century author who described woman as "God's work and the adornment of humanity" before affirming, "We welcomed with gratitude the decision to abolish women's competition for dan grading; from now on, our female candidates will need only to demonstrate skill, flexibility and technical mastery. Their natural grace will be fully expressed through the practice of *kata* and, once again, the educational value of judo, beyond the spirit of competition itself, will be clearly proven" (Ficheux, 1957). The Kodokan thus imposed its model and reinforced the convictions of instructors, providing a pretext for those who reserved strength for young men and aesthetics for young women.

In the journal of the very traditional Black Belt College, comments were less restrained, "Look at an experienced *judoka*. He may have the speed of a bear but he also has the gait of the animal … Women's judo must produce graceful movements, which are the primary expression of feminine beauty" (Parent, 1963). This period made technical expression the preferred domain of women's practice and highlighted the example of Jeanne Liberman, president of the association "Health through Breathing," who began studying judo in 1953 at the age of sixty-two. Four years later, she passed her first-dan examination and became the oldest French woman to earn a black belt (Liberman, 1958). Women thus retained their place within the French judo milieu. Their presence was continuous and attracted the attention of the popular press. The magazine Paris-Match devoted a double page and four photographs to young actresses "throwing their instructor to the floor." The article announced what looked like a new trend, "The first women's judo club has just opened in Paris. It has become as indispensable in the 61 Parisienne's timetable as the hairdresser or the beauty salon. The black belt will soon be one more feminine touch" (Gragnon & Pedrazzini, 1961).

The compartmentalisation of roles reflected a broader tendency in French society, still reluctant to grant women an equal status. The failure to sustain women's competition after Kawaishi can also be explained by the combination of a devaluing discourse and a still discordant social context. Histories of feminism show that the 1950s were a phase of regression. In 1949, the publication of Simone de Beauvoir's The Second Sex generated intense controversy but met with relative indifference within feminist circles themselves (de Beauvoir, 1949). Sociologist Rose-Marie Lagrave describes this period using striking expressions such as "social disillusionment" and "disenchantment with the 'Thirty Glorious Years'" (Lagrave, 1992, pp. 431–462). The conditions for change, both social and internal to judo, ran up against the persistence of entrenched representations. As Hargreaves noted, "The power of images is essentially ideological; they reflect a shared system of values and meanings. And ideologies relating to women's sport are not just abstract ideas, they are a material force which permeates experience and are difficult to change" (Hargreaves, 1994, p. 172).

The cultural clashes revealed by Kawaishi's personal trajectory show that women's judo in France did not result from a simple transfer of the Japanese model but from an unstable compromise between commercial logics, masculine traditions and women's aspirations to the autonomy promised by the ability to defend themselves through judo. This compromise formed part of a broader movement in which the flows analysed by Appadurai were taking shape heralding an acceleration of cultural exchanges with the arrival of new "masters," the multiplication of demonstrations and the refinement of a discourse on the values of a discipline presented as a distinctive knowledge of the body and a school for character formation.

The time of athletes

Continuities and ruptures

Any analysis of the evolution of women's judo must begin with the mapping of the global spread of Kano's method. Two distinct zones emerge. The first corresponds to the areas shaped by the Japanese diaspora and the British colonial empire. There, Japan exerted cultural, political and economic influence, notably through trade, early diplomatic relations between the two countries and privileged ties between Kano and Koizumi (Bowen, 2011; Brousse, 2015). The Kodokan model of judo functioned as the only legitimate reference. The second area is that of France, its influence in Europe and its colonial empire. Here, the dominant model is the system established by Kawaishi. The techniques lose their Japanese names; they are renumbered and reclassified and each kyu grade is accompanied by a specific teaching programme. Above all, self defence retains a significant place and commercial logic is mobilised to promote the discipline. Gender hierarchy is no longer reinforced by differentiated teaching content. Women's practice depends more on practitioners' choices and market logic than on a gender-based social order.

However, the autocratic system established by Kawaishi began to falter with the arrival of Ichiro Abe in France in the early 1950s. After a short but intense period of conflict, Abe was forced to leave France and settle in Belgium; from that point on, Kawaishi's power gradually declined. Contacts with Japan increased and the new French leadership chose to align itself more closely with the Kodokan model. The impact on women's judo was immediate. In Belgium, at the end of the 1950s, Ichiro Abe, Kodokan envoy, and Raymond Delforge, federation president, "temporarily put an end to the sportification of women's judo, which they regarded as inappropriate for women" (Groenen, 2012, p. 1831).

How, then, should we interpret the fact that, at the very moment when Japan had been militarily defeated, judo was disseminating in Europe and the United States not only masculine but also feminine models of service to the nation-state? In Games and Empires - Modern Sports and Cultural Imperialism, Allen Guttmann examines the influence of the various forms of political, economic and cultural power that he, following Antonio Gramsci, defines as "cultural hegemony." The desire to transmit specifically national cultural values was a constant in the approach of many Japanese judo pioneers. In this case, cultural hegemony does not stem, as in Gramsci's original critique, from the desire of dominant social classes to subordinate the proletariat, but rather from the aim of promoting a certain vision of society and of the world. The circulation of an idealised and often fantasised image of judo thus provides a model for individual emulation and social mobility. Referring to our work, Guttmann writes, "Judo is an even more striking example of reverse diffusion because it took hold in Europe and the United States at a time when Japan, defeated on the battlefield and subjected to military occupation, had barely begun to recover from the material ravages of war. As a rule, however, receptivity to 'exotic' sports is limited to the most affluent and better educated sectors of the population" (Guttmann, 1994, p. 174). Far from being the product of a simple one way transfer, women's judo in France thus appears as the outcome of a series of compromises and conflicts in which issues of gender, class and national culture intersect.

The circulation of experts and the narratives woven around their exploits highlight the promises that surround public representations of judo. Internally, membership of the French federation grew rapidly. Massification went hand in hand with democratisation and with the 'juvenilisation' of practitioners. Women's participation grew quickly. In 1963, women accounted for 5.5% of members (out of 67,024 licence-holders); in 1973, 14.5% (out of 258,521). By 1978, the share of women had risen to 18.9% (out of 342,073) (France Judo. (2026)).

The inclusion of men's judo in the Olympic programme at the IOC's 58th session, in July 1960, constituted a turning point that transformed the everyday routines of training. The rapid multiplication of intermediate age and weight categories entailed a more systematic quest for performance and a growing distance from traditional forms such as *kata* and self-defence. Judo classes were reorganised into training sessions which, in practice, tended to equalise training formats for men and women. The ban on women's competition became increasingly difficult to justify, especially as broader social change was reshaping gender relationships.

As French judo evolved into a modern sport and opened up to new audiences, the legal and cultural framework defining women's place in French society was itself also reconfigured. The period of economic growth known as the 'Trente Glorieuses' saw a series of reforms that redefined women's conditions of existence: the legalisation of contraception, the affirmation of professional equality, the liberalisation of abortion, the generalisation of co education in schools, and an increase in free time and personal leisure. In this new landscape, the sporting legitimation of women *judoka* appears less as an exception than as one of the modalities of the broader reconfiguration of gender relations. National heroic figures were no longer the military leaders of the past, but admired sportsmen and sportswomen, new symbols of success and modernity. Female champions offered young girls alternative models of identification beyond the traditional roles of mother and wife. This constellation of transformations was by no means limited to France; it formed part of a wider international movement redefining gender relationships, of which International Women's Day is one of the most visible symbols.

Class struggle and women's competitions

The convergence between broader social developments and the transformation of modes of practice made the argument for a 'different' judo for women increasingly untenable. The confrontation between supporters and opponents of women's competition now unfolded essentially on institutional and ideological ground. In France, the silent pressure exerted on the tatami was compounded by the explicit social pressure exerted by the Fédération Sportive et Gymnique du Travail (FSGT).

In the immediate post-war period, workers' sport worked to democratise access to sporting practices and sought to assert its identity by pursuing a strategy of competition with the leading federations. In an introductory speech at the first FSGT Paris Championships, held in Drancy on 9th March 1949, J-P. Rose declared, "There is no reason why the possessing classes should be the only ones to practise judo. Professors in Paris charge between 1,500 and 3,000 francs a month. We charge between 100 and 150 francs…" (Brousse, 2005). Although not prohibitive, membership fees in mainstream clubs represented a significant financial effort for a working class household. In 1950, the introduction of a guaranteed minimum wage set monthly pay at 13,566 francs. By reducing the cost of access drastically, the FSGT turned judo into a resolutely popular activity, rather than a leisure pursuit of the middle and upper classes.

The rivalry openly asserted by the FSGT judo section was reflected in the organisation of a men's national championship by weight categories as early as 1955, followed by a women's national championship in 1964. In some regions of France, mass events emerged, bringing together several hundred practitioners. In line with the same logic of popular mobilisation, judo competitions were transformed into large scale fêtes. Points of rupture were strong and multiple. The FSGT appeared as an actor in class struggles within the sporting field, challenging a bourgeois and masculine definition of competitive judo and, through practice, asserting the legitimacy of women's tournaments. The FSGT's competitive policy can thus be read as an attempt at working-class counter-hegemony in the face of the dominant federal model, echoing John Hargreaves' analysis of sport as a privileged terrain on which class and gender divisions are constantly replayed (Hargreaves, 1986).

Since 1963, the French state had required the presence of women on federal governing bodies, to reflect 10% of female licence holders. In December 1974, Josiane Litaudon was co opted onto the national executive committee, becoming the first woman to sit on this body. She became a staunch advocate for the interests of female practitioners and elite athletes. Her task was made difficult by an unfavourable climate. A few months earlier, René Audran, the new president of the French federation, had declared to a journalist from France-Judo that he was personally opposed to women's competition. Yet, despite his regret that women's judo had not found another mode of expression, and in view of the strong groundswell that was emerging, he indicated that the FFJDA would allow young women to participate in tournaments. This lukewarm stance clearly reveals the persistence, at that time, of a deeply gendered view of legitimate uses of judo.

The French athletes' defeat at the 1960 Rome Olympics led to major structural reforms in the organisation of sport in France. French judo benefited greatly from this. The official inclusion of judo in the Tokyo Olympic Games prompted President Georges Pfeifer and technical director Henri Courtine to pursue a highly proactive sports policy. The outstanding achievements of the French champions in the 1970s inspired new vocations and transformed daily life at the dojo profoundly. In this context, it became increasingly difficult to keep women *judoka* away from a competitive judo enthusiastically embraced by the majority.

A similar trend could be observed abroad. Women's contests were organised in West Germany, Switzerland, Austria, Italy and Great Britain. These initiatives led the European Judo Union to stage an experimental competition in Genoa in 1974. The first women's European Championships took place the following year in Munich. The French team won five gold medals, three silver and one bronze. Their victories were all the more symbolic in that 1975 had been declared International Women's Year. In the face of the determination of Josiane Litaudon and those around her, French leaders were forced to adapt all the more rapidly as they were keen to avoid a split and the creation of an independent women's federation.

De-Kodokanisation through sport

The globalisation of competitive judo, and in particular the gradual inclusion of women into major events, marked a decisive turning point in the 'de-Kodokanisation' of women's judo and in the redefinition of gender boundaries within the sport. At a meeting held during the Munich Olympic Games, the international federation announced its support for the new project; a women's World Championships would be organised as soon as three continents had held their own continental championships. The first world event took place in New York in 1980. Its organisation owed much to 'Rusty' Kanokogi, who played a decisive role in removing, one by one, the last obstacles to the institutional recognition of women's competitive judo (Atkinson, 1983, Kanokogi, 2020). Together with her friend Billie Jean King, she had campaigned for the adoption, by the US Congress in 1972, of legislation prohibiting sex discrimination in high-school and collegiate sport. She succeeded in convincing IJF President Shigeyoshi Matsumae, who granted his support for these first championships, which brought together several dozen countries and more than a hundred women competitors.

Initially held separately, the men's and women's world championships were combined for the first time in Essen

in 1987. The media and political importance attached to Olympic medals was directly linked to the budgets allocated to national federations. At the major events, competitors from Japan, France and the countries of the Eastern bloc left little room on the podia for *judoka* from other countries. In contrast, women's competitions opened up new prospects for victory to teams that had hitherto won few international honours. Emerging nations such as Cuba and China reshaped the map of world judo and, in doing so, shifted gender hierarchies by imposing new, legitimate styles of combat within the sporting arena.

The final step was the inclusion of women's judo in the Olympic programme. Although difficult, the decision was taken relatively quickly. At its 90th session, in Berlin, the IOC agreed to include women's judo as a demonstration sport at the Seoul Games. Since 1992, men's and women's judo events have been a permanent feature of the Olympic programme. The process of international sportification thus produced a dual movement: a progressive de-Kodokanisation of women's judo and their acquisition of full legitimacy at the very heart of the Olympic model.

The Barcelona Games marked a turning point. Through the performances of its champions, women's judo there appeared as a fully mature expression. It was integrated into the Olympic programme on an almost equal footing, with a set of women's events mirroring that of the men. The standard of performance among women *judoka* continued to rise and now elicited the admiration of the entire judo community, combining technical excellence with determination and fighting spirit. Ryoko Tamura's long pursuit of the Olympic title that had eluded her, secured her a place in history as an exemplary figure, capable of combining extreme performance, media visibility and the redefinition of social expectations regarding sportswomen.

Recognition of women's expertise in judo extends beyond the podium alone. In Japanese Women and Sport, Robin Kietlinski cites a January 2007 article from the Yomiuri Shimbun, the world's best-selling daily newspaper with almost seven million copies sold each day, "Tani's (neé Tamura) return does not only hold great significance in the judo world but in Japan's sporting world as well. To date, there have been athletes who continue competing after being married but no top athletes who have comeback after giving birth to a child. Moreover, if Tani proves to be successful in her comeback, the impact will go beyond that of rapid progress for female athletes – the social impact could also be great –, as it will show that 'returning to work after childbirth' is a viable option for Japanese women today" (Kietlinski, 2011). In many countries, former champions have become public icons and some have not hesitated to enter politics, being elected to parliament or appointed to ministerial office. Yet this institutional recognition was nonetheless the outcome of a long and arduous administrative struggle.

The trajectories of Ryoko Tani-Tamura in Japan, Yael Arad in Israel, Miriam Blasco in Spain and Paula Pareto in Argentina illustrate, each in their own way, how judo can become a decisive form of capital for breaking the glass ceiling. On a different scale, Yvonne Ploetz in Germany and Jacqueline de Quattro in Switzerland show that a lower level of practice but an identical passion for judo can nourish a habitus of combativeness, respect for rules and effective conflict management, which become resources in parliamentary and executive arenas. Taken together, these examples show how judo forges in these women a specific relationship with power, grounded in bodily mastery, respect for opponents and the capacity to face obstacles head-on. The confidence acquired through the exercise of adversity reinforced the confidence placed in them and enabled them to circumvent, shift or crack the gender barriers that ordinarily constrained women's careers.

Change has also affected judo's governing bodies. In 2005, in France, Brigitte Deydier, a former world champion, was appointed national technical director of judo; in Brazil, Rosicléia Campos established herself as the highly charismatic head coach of the national women's team. In 2023, Lisa Allan was elected Secretary General of the International Judo Federation. Women's access to these positions of authority challenges traditional patterns of expertise, leadership and masculinity. In this reconfigured landscape, women's performances have become a matter of national prestige, further intensifying the de-Kodokanisation of women's judo. In 1999, the International Judo Federation ended the use of the black belt with a white stripe on the grounds that it was discriminatory. As for national competitions, the All Japan Judo Federation did not adopt this decision until eighteen years later.

The inclusion of women's judo in the Olympic Movement led to an almost immediate acceleration in the circulation of people and ideas. The media found in the personalities of women champions compelling examples of courage and achievement that captured the attention of their audiences in new ways. The image of competitive judo did not, however, erase the values promoted by Kano. A new balance was established, breaking the association between intense physical confrontation and masculinity on the one hand, and a form of femininity restricted to non-oppositional practice on the other. Contemporary women are free to choose their own mode of judo practice.

CONCLUSION

The history of women's judo in France cannot be understood either as a simple 'delay' represented by its relationship to the male model or as a linear transfer of Japanese judo. As an example of reverse diffusion, it is the result of a succession of compromises, tensions and reconfigurations in which power relationships between sexes, nations and sporting institutions are constantly renegotiated. The 1970s and 1980s marked the transition from a judo of female pioneers, supervised by male intermediaries and constrained by bourgeois norms of fe-

mininity, to a judo of sportswomen fully engaged in major international competitions. The progressive de-Kodokanisation of women's judo, driven by access to elite sport and by the growing weight of media and financial stakes, has not abolished these constraints but has shifted their forms and modes of expression.

Within this trajectory, the French case is not merely that of a 'receiving' country for Japanese judo. It is also that of a structuring actor in the development of women's judo worldwide. The French example reveals a particular configuration linked to the way Kano's judo took root and spread in France, between alterity, autonomy and appropriation (Brousse, 2005). French leaders played a leading role in the evolution of world judo throughout the second half of the twentieth century. Although France's influence is more limited today, the choices it makes remain scrutinised closely. French judo has been particularly active in promoting women's judo. The figures speak for themselves. Since 2024, the proportion of women practitioners has remained consistently above 34%. Between 2015 and today, taking world championships and Olympic Games together, French judo has won 63 medals, 18 of them by men and 45 by women (France Judo, 2026). This strength lies as much in results as in the scale of the organisation, the size of the membership, a proactive federal strategy and the early integration of women into training structures and elite pathways – an ensemble that constitutes a recognised model from which many nations draw inspiration.

The International Judo Federation has also placed equality at the centre of its policies and discourse. In 2026, IJF President Marius Vizer declared, "On the occasion of International Women's Day, we are reminded that progress toward equality is not a destination but a continuous and shared responsibility. Judo is an educational journey, a discipline and a path to build stronger individuals, contributing to a better society. Its moral code transcends gender, nationality, culture and belief. On the tatami, individuals meet as equals, guided by respect and united by shared values. This is not only our heritage; it is our enduring responsibility" (Vizer, 2026). The torch passed on by pioneers such as Keiko Fukuda, Josiane Litaudon, Rusty Kanokogi and many others is today held high by the members of the IJF Gender Equality Commission, chaired by Dr Sanda Čorak.

Yet examining the recognition of women and their equal access to the competitive arena is also to compare judo with other practices described by Elias and Dunning as a "male preserve." The first men's world championships took place in Tokyo in 1956, twenty-four years before the women's competition in New York (wrestling 1904–1987; weightlifting 1891–1987). In judo, unlike tennis or athletics, men's and women's events are now identical in nature, in duration and in refereeing rules. The only formal difference lies in the requirement for women to wear a white T-shirt under the *judogi* jacket.

By systematically following the circulation of people, techniques and images, we gain a clearer view of how gender boundaries are being reshaped in a sport long regarded as a bastion of virility. It is at the intersection of national histories, global circulations and struggles for athlete dignity that the credibility of judo's moral code, and the real scope of its commitment to gender equality, are now at stake. The challenge is no longer a simple question of whether men and women practise the same form of judo. Nor is it merely a matter of noting that women are now allowed to stand on the podium of tournaments. The challenge is to ensure that they can do so safely, without having to compromise their convictions or integrity, and to create the conditions to fulfil Kano's vision of "social harmony and human progress" (Kano, 1933, pp. 504–507).

More sensitive issues have emerged beyond the sporting stage. Autobiographical accounts of harassment and sexual assault against athletes, brought to light in recent years, remind us that entrenched hierarchies of power, the weight of sporting careers and institutional silences can contradict the values displayed on dojo walls sharply. Controversies over refusals to bow to opponents for political reasons, or recurring debates on the wearing of the hijab in competition, show that women *judoka*'s bodies remain caught in tensions that extend well beyond the confines of sport. Religious, geopolitical and legal conflicts put the principles of equality and mutual respect claimed by the judo community to the test. Sport has enabled women to step out of the shadows within the Kano method, putting an end to women's invisibility in judo. It is in the face of these tensions and daily struggles that we can ultimately gauge modern judo's ability to transform its legacy into a genuine policy of gender equality for future generations.

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Engineering Decision-Making in Judo: A Taguchi Orthogonal Array Framework for Technical-Tactical Circuit Design

By Ahmed Nabil Taher Elalem

Abstract: *Elite judo performance relies on decisions made in under two seconds, shaped simultaneously by the opponent's grip, posture, height and movement direction. Circuit training is a general sport conditioning method widely adopted in judo but its application to judo has remained largely physiological. Stations repeat with fixed tactical content, so athletes build fitness without the situational adaptability that competition demands.*

This paper proposes a circuit design framework that uses Taguchi orthogonal arrays (OA) to cover the competitive constraint space systematically. An L18 mixed-level OA organises 18 station scenarios from five factors: fighting side, relative height, posture, kumi-kata configuration, and movement direction. Each row of the array is a distinct constraint combination. Because the array is balanced by construction, every factor level gets equal practice time across the session, with no increase in total training time and no reliance on coaching intuition to cover the scenario space.

The framework is grounded in Sacripanti's biomechanical classification of throwing techniques, competition time-motion data and long-term athlete development principles. Stations progress from dynamic uchi-komi to constrained randori as technical consistency develops. Four outcome measures are defined for future empirical testing: time to first effective attack, effective attack rate, decision accuracy, and rate of force development. Together they provide a structured basis for validating whether systematic constraint coverage improves decision-making under competition conditions.

Keywords: *judo; circuit training; decision-making; orthogonal arrays; biomechanics; long-term athlete development*

Judo is a situation sport. No two contests follow the same pattern, because the opponent's actions continuously reshape what is possible at every moment of the contest. Sacripanti (2021) formalises this by placing judo within the category of 'situation sports,' defined as contact sports in which performance cannot be characterised by repeatable movement sequences. Training environments that do not reflect this variability will leave athletes underprepared regardless of how fit they are.

The competitive numbers support this. The athlete couple shifts across the tatami at 0.2 to 0.4 m/s on average, covering approximately 121 metres per contest (Sacripanti and Ahmedov, 2021; Matsumoto, Takeuchi and Nakamura, 1978). When an attack begins, speed rises to 1.3 to 1.8 m/s, roughly five times the approach pace. The throwing phase averages 1.86 ± 0.9 seconds; the locomotion phase between attacks averages 11.52 ± 6.1 seconds; ne-waza exchanges average 7.01 ± 4.5 seconds. Mean contest duration is 178 ± 11 seconds, with 72 percent ending before full time and 19 percent going to golden score (Sacripanti and Ahmedov, 2021). Plasma lactate averages approximately 12.3 mmol/L during competitive effort, with peak leg power declining significantly across successive contests (De Goutte, Jouanel and Filaire, 2003; Bonitch-Dominguez et al., 2010). Each attack window is narrow, the physical demand is high, and the decision of which technique to use must be made and executed in under two seconds.

That decision depends on what the opponent is doing. The grip, relative height and posture, direction of movement, and distance from the contact all determine which technique is mechanically viable. Sacripanti (1987) showed that all throwing techniques belong to one of two families: couple of forces techniques and physical lever techniques. Each family has distinct energy demands and specific conditions under which it is executable. A technique that works at high approach speed may not work when both athletes have stopped, and a technique suited to a taller opponent may fail against one who is shorter.

Competition analysis confirms this variability. Calmet and Pierantozzi (2021) studied 28 elite *judoka* across 122 contests and 973 attacks. On average those athletes attacked across six directions, used up to six *kumi-kata* configurations, and scored in roughly 11 to 12 percent of attempts. Attacking on the same side as the *kumi-kata* configuration increases scoring probability regardless of sex or weight category, with same-side attacks in *kenka-yotsu* particularly effective among lighter athletes (Courel-Ibanez, Herrera-Valenzuela and Franchini, 2014, as cited in Sacripanti, 2021). Weight categories show distinct patterns: lighter athletes use rapid anticipatory grip-

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ping at long contact distance, middleweights use varied combinations at medium distance, and heavier athletes rely on defensive collar and back grips with proximal force application (Brito, Aedo-Munoz and Miarka, 2020; Lopez Diaz-de-Durana et al., 2018).

Circuit training has a long history across different sports and judo has used it extensively, but its application in judo has not kept pace with what competition analysis now tells us. Sterkowicz-Przybycien, Miarka and Fukuda (2017) noted that training programmes rarely account for the technical-tactical differences between weight categories identified in time-motion studies. Miarka et al. (2014) found that the approach, gripping, technique, and ne-waza phases of competition are seldom replicated in circuit sessions. Brito, Aedo-Munoz and Miarka (2020) observed that athletes across different categories are routinely given the same training stimulus regardless of the specific competitive demands of their categrory. The result is athletes who are fit but not tactically prepared.

This paper proposes a design framework for technical-tactical judo training circuits using Taguchi orthogonal arrays (OA). The framework was first developed in the author's MSc dissertation at the Universita degli Studi di Roma 'Tor Vergata' (Elalem, 2013) and is presented here in substantially revised and expanded form for peer-reviewed publication.

Scope and nature of the present study

This study is a conceptual framework paper that proposes a systematic design methodology for circuit training, applied to technical-tactical judo preparation. No experimental validation is presented; instead, the framework is grounded in established biomechanical, ecological and performance analysis literature, with future empirical testing proposed. Readers should interpret all references to expected outcomes, projected benefits and design rationale as theoretical propositions derived from the cited evidence base, not as claims supported by direct experimental data from this study.

From Conditioning Circuits to Decision-Centered Practice

Circuit Training in Sport and Its Adoption in Judo

Circuit training was developed by Morgan and Adamson (1953) for general physical conditioning through sequential stations with limited rest and was later systematised for multiple sports by Scholich (1999). It is used by many sports for its logistical simplicity and compatibility with group sessions. Judo adopted it on the same basis. The French Judo Federation (FFJDA) built one of the most integrated models, arranging the classical Japanese training sequence (*tandoku renshu, uchi-komi* and *nage-komi, kakari-geiko* and *yaku-soku-geiko, randori*) into structured circuits alternated with physical exercises across all athlete levels (Sacripanti, 2021). As task complexity increased in those circuits, training shifted from basic physical development toward technical diversification, which is beneficial, specifically at advanced levels (Sacripanti, 2021). Figure 1 shows the standard design sequence for a judo training circuit.

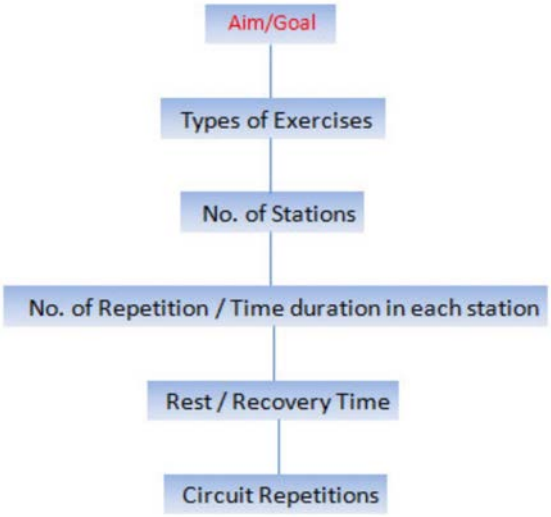

Figure 1. Design stages of a judo training circuit (Elalem, 2013, Figure 3.1) Source: Author's MSc dissertation, Universita degli Studi di Roma 'Tor Vergata'.

Current practice has kept the conditioning function while largely dropping the tactical one. Contest analysis has confirmed that judo performance is characterised by specific sequential phases with distinct tactical demands at each stage (Sacripanti, 2013), yet stations in most circuits repeat with minimal modification across sessions; grip configurations stay fixed and opponent behaviour is either scripted identically each time or left to chance. A physically demanding session is the result but the decision-making skills that transfer to competition are not trained (Sterkowicz-Przybycien, Miarka and Fukuda, 2017; Miarka et al., 2014).

The Need for Systematic Constraint Variation

Practice tasks must preserve the perceptual cues and action possibilities of the competitive environment (Pinder, Davids, Renshaw and Araujo, 2011). Opponent grip configuration, posture, relative height and movement direction are not incidental features of competition; they are the cues that determine which technique is mechanically viable at each moment. Training that omits or fixes them removes the very information athletes must learn to read.

When training conditions differ substantially from competition conditions, athletes develop skills specific to the training context that do not transfer (Renshaw, Chow, Davids and Button, 2010). A circuit that uses a fixed grip, a fixed opponent height and a fixed movement direction prepares athletes for a situation that does not exist in real competition.

Random variation helps but it does not guarantee that the scenarios that matter most in competition get adequate practice time. Araujo and Davids (2011) argued that what athletes acquire through practice is sensitivity to the conditions that make each technique viable. Organising that exposure efficiently, within the time available in a training session, is a design problem that calls for a design method.

Theoretical Foundations

The OA-based circuit framework rests on three interlocking theoretical pillars.

Ecological dynamics and the rationale for variability. Gibson (1979) established that perception and action are coupled: athletes perceive action possibilities offered by the environment and respond to them directly. Davids, Button and Bennett (2008) extended this into the ecological dynamics framework for skill acquisition, arguing that athletes must be exposed to the same information-movement relationships in training that they will face in competition. For judo, grip configuration, opponent height, posture and movement direction cannot be fixed or randomly omitted; they must be systematically varied, because they are the perceptual cues that govern which technique is viable at each moment. The OA-based framework addresses this by treating those cues as design factors rather than as background noise.

Constraints-led approach and the selection of factors. Newell (1986) proposed that movement emerges from the interaction of three constraint categories: organismic (athlete characteristics), environmental (surface, space, equipment), and task (rules, goals, implements). Renshaw, Chow, Davids and Button (2010) applied this framework to coaching, arguing that the coach's primary role is to manipulate task and environmental constraints to channel movement solutions toward those that are competitively effective. The five factors chosen for the L18 array (fighting side, relative height, posture, *kumi-kata*, and movement direction) represent the task and environmental constraints shown, by competition analysis, to most strongly influence technique selection in elite judo (Sacripanti, 2021; Calmet and Pierantozzi, 2021; Brito, Aedo-Munoz and Miarka, 2020). Their inclusion in the array follows from that evidence, not from theoretical convenience.

Biomechanics and the constraint-technique relationship. Sacripanti's (1987, 2021) biomechanical classification establishes that technique selection in judo is not arbitrary. The physical laws governing couple of forces and lever mechanics mean that a given constraint combination renders some techniques mechanically efficient and others mechanically futile. Relative height alters lever arm geometry; opponent posture changes the available *kuzushi* directions; shifting velocity determines whether lever techniques are executable at all. This layer converts the training design problem from a general observation about variability into a specific prescription: vary these five factors, assign them to these technique families, and build stations accordingly. Ecological dynamics identifies the need for variability, the constraints-led approach specifies which constraints to vary, and biomechanics determines what each constraint combination means for technique selection and station content.

Systematic Sampling of Competitive Constraints

Design-of-Experiments Logic Applied to Training

Design-of-experiments (DOE) methods were developed in quality engineering to analyse multiple factors simultaneously while keeping the number of trials to a practical minimum (Taguchi, 1986). Applied to training design, the goal is not statistical inference but balanced scenario coverage: ensuring that every important competitive condition gets equal training time across a session.

For coaches, the practical value is straightforward. Instead of constructing scenarios by intuition or repeating the same opponent configuration session after session, the coach uses a pre-constructed matrix in which every constraint appears with equal frequency. No scenario is avoided accidentally and no training time is spent on variations the athlete already handles well.

Orthogonal Arrays as Station Selectors

Taguchi orthogonal arrays (Taguchi, 1986) are pre-constructed matrices in which every competitive constraint is balanced across all factor combinations in the session. Each row of the array is a station description: a specific set of competitive conditions the athlete must solve during that station.

Multiple constraints interact continuously in a judo match. Training only one in isolation does not replicate this. Varying all possible combinations creates more stations than any session can accommodate. Orthogonal arrays solve this by covering the full scenario space with the minimum practical number of stations. An L18 array generates 18 station scenarios from five competitive constraints, completing that coverage in an 80-minute session.

Why Orthogonal Arrays? Comparison with Alternative Approaches

Several methods exist for introducing competitive variability into training. Understanding why the OA approach is preferred over the main alternatives clarifies both its strengths and its boundaries.

Controlled randomisation assigns constraint combinations to stations randomly for each session. This is simple to implement but produces a different constraint coverage

profile every session, making it impossible to know which combinations have been underserved over time. An athlete may coincidentally avoid facing taller opponents in *jigotai* with a cross-grip for several consecutive sessions, not because the coach planned it but because randomisation produced that outcome. Orthogonal arrays eliminate this risk by guaranteeing equal coverage of all constraint pairings within a single session.

Block periodisation of scenarios groups similar constraint combinations into training blocks (e.g., one week focused on kenka-yotsu, the next on opponents in jigotai). This builds depth within each constraint but sacrifices the simultaneous multi-constraint exposure that competition demands. A judo contest does not present one constraint at a time; technique selection is always shaped by all five factors acting together. The OA circuit trains the combined interaction from the outset.

Adaptive design adjusts constraint difficulty in real time, based on athlete performance, for example increasing the opponent's height or grip difficulty after successful executions. This is pedagogically sound for individual skill development but requires substantial real-time monitoring infrastructure, individual session planning for each athlete, and coaching expertise that goes beyond what most club environments can sustain. The OA circuit runs the same array for all athletes at a given stage, making it scalable to group training without individual session redesign.

The primary limitation of the OA approach relative to adaptive design is its inability to respond to individual athlete performance within a session. An athlete who finds station 7 trivially easy and station 14 impossible will spend equal time on each. Coaches should use the Whole-Part-Whole correction method (Schmidt and Wrisberg, 2008) to address specific weaknesses between sessions rather than adjusting station time within the array. A secondary limitation is that the L18 structure fixes the number of stations at 18. Coaches who want to add a sixth factor, such as ne-waza continuation, must use a larger array (L27 or above), which extends session time beyond 80 minutes. The OA approach scales up in a mathematically predictable way but only at discrete array sizes. The primary limitation relative to adaptive design is that the OA circuit cannot respond to individual athlete performance within a session; a station that proves trivially easy and one that proves impossible each receive equal time.

Biomechanical Foundations

Kano (1994) subdivided the throwing movement into three stages: *kuzushi* (breaking *uke*'s balance), *tsukuri* (fitting tori into the throwing position), and *kake* (the throw itself). Figure 2 shows these stages in competitive throwing.

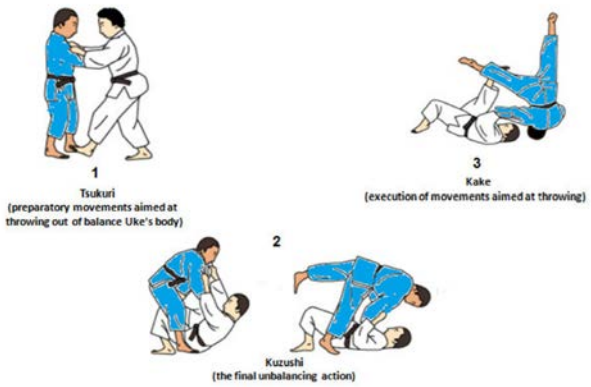

Figure 2. The three stages of the throwing movement: *kuzushi*, *tsukuri*, and *kake* (Elalem, 2013, Figure 4.3) Source: Author's MSc dissertation, Universita degli Studi di Roma 'Tor Vergata'.

Static equilibrium requires both translational equilibrium ($\Sigma Fx + \Sigma Fy + \Sigma Fz = 0$) and rotational equilibrium ($\Sigma \tau = 0$). Effective *kuzushi* disrupts one or both. Couple techniques operate primarily through the moment equation, generating torque that rotates *uke* around the body's own centre of mass without a large net translational force. Lever techniques primarily exploit the translational equation, projecting *uke*'s centre of mass through space over a fixed fulcrum. Figure 3 shows the force vectors acting on a standing *judoka* in balance.

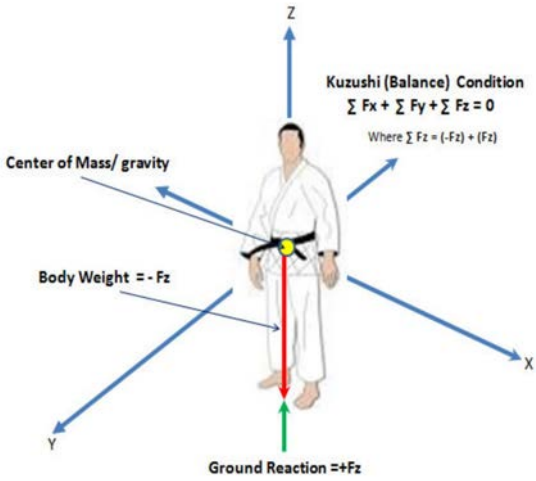

Figure 3. *Kuzushi* balance condition: force vectors acting on a standing *judoka* (Elalem, 2013, Figure 4.4a) Source: Author's MSc dissertation, Universita degli Studi di Roma 'Tor Vergata'.

Sacripanti (1987, 2010) classified all throwing techniques into two mechanical families. Couple of forces techniques, such as *uchi-mata, osoto-gari*, and *ko-uchi-gari*, rotate *uke* around the body's own centre of mass and are less expensive energetically (Figure 4). Physical lever techniques, such as *seoi-nage* (variable arm) and *tai-otoshi* (maximum arm), project *uke* through space over a fixed fulcrum and are more gravity-dependent and costlier in energy (Figure 5). Data from 104 contests (555 throws) shows 51 percent lever-based and 49 percent couple-based, with couple techniques scoring in 33 percent of attempts versus 24 percent

for lever techniques. Mean gross power is estimated at 2.3 kW for lever and 1.7 kW for couple throws (Sacripanti and Ahmedov, 2021; Sacripanti et al., 2015).

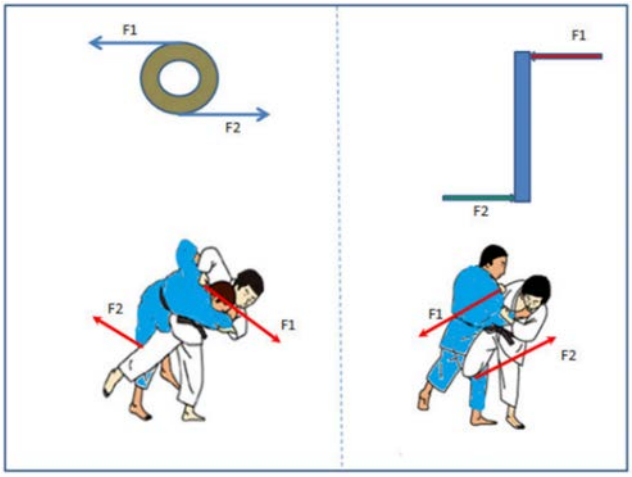

Figure 4. Couple of forces principle: mechanical model (above) and competitive application (below) (Elalem, 2013, Figure 4.6). Source: Author's MSc dissertation, Universita degli Studi di Roma 'Tor Vergata'.

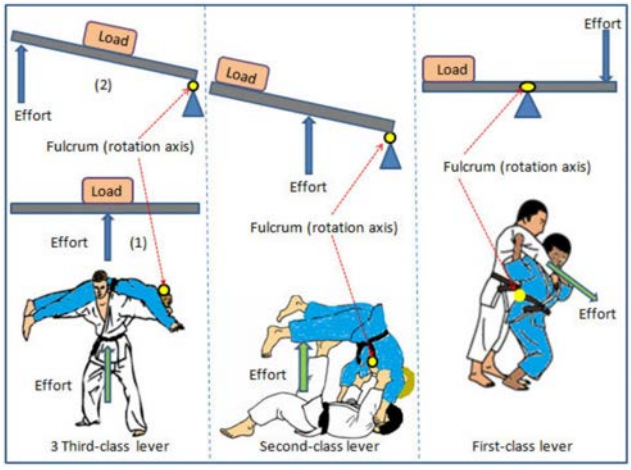

Figure 5. Physical lever principle: first, second, and third class levers with competitive examples (Elalem, 2013, Figure 4.7). Source: Author's MSc dissertation, Universita degli Studi di Roma "Tor Vergata".

Ashi-waza account for 32 percent of the Kodokan *nage-waza* total (Figure 6), reflecting its sustained dominance in competition (Sterkowicz and Franchini, 2000). Attack distance groups techniques into *chica-ma-waza* (short body contact), *ma-waza* (medium distance), and *to-ma-waza* (long first-contact distance). Combinations that change distance group have a mechanical logic that changes of direction alone do not provide.

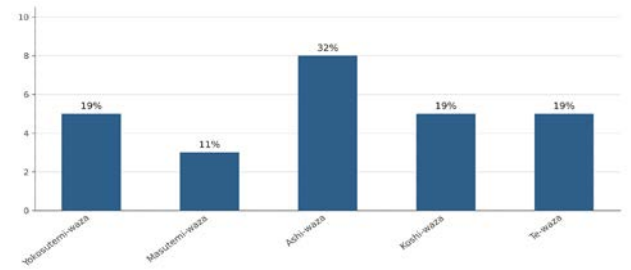

Figure 6. Distribution of Kodokan *nage-waza* throwing techniques by group (Elalem, 2013, Figure 4.2) Source: Author's MSc dissertation, Universita degli Studi di Roma 'Tor Vergata'

Kumi-kata is the entry point for all of this. The effectiveness of a grip depends as much on foot position as on hand position: ground reaction force travels from the feet through the legs and core to the arms, and without stable foot contact, arm position contributes nothing to the throw (Sacripanti, 2021; Knudson, 2007; Adams, 1992). Sacripanti identified eleven functional roles of gripping (Guido, 2011; Elalem, 2013), and these roles determine which aspect of the force chain the coach should address when a circuit station fails consistently.

Framework for OA-Based Technical-Tactical Circuit Design

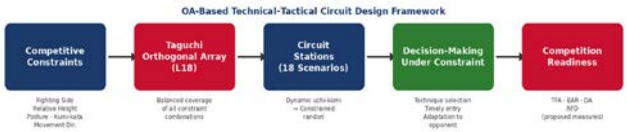

Figure 7. Conceptual framework: how competitive constraints are processed through the orthogonal array into circuit stations, developing decision-making and competition readiness. Proposed outcome measures (TFA, EAR, DA, RFD) are shown at the right for future empirical validation.

Selection of Competitive Constraints

Five constraints were selected on the basis of their influence on technique selection and decision-making in competition (Elalem, 2013; Sacripanti, 2021; Brito, Aedo-Munoz and Miarka, 2020; Calmet and Pierantozzi, 2021).

Fighting side (FS): right versus left opponent stance. The critical distinction is between *ai-yotsu* (both athletes on the same side) and *kenka-yotsu* (athletes on opposite sides). Same-side attacks in *kenka-yotsu* carry higher scoring probability, particularly among lighter athletes (Courel-Ibanez, Herrera-Valenzuela and Franchini, 2014, as cited in Sacripanti, 2021). The current framework defines FS at two levels as an initial simplification that holds tori's own fighting side constant; future versions should expand to a three-level factor capturing *ai-yotsu* right, *ai-yotsu* left, and *kenka-yotsu* configurations explicitly. Athletes who train only against same-side opponents carry that gap into competition (Elalem, 2013).

Relative height (RH): shorter, same height or taller. Height asymmetry changes lever arm lengths in lever techniques and the force couple geometry in couple techniques. Lighter athletes engage in anticipatory gripping against same-height opponents; heavier athletes use defensive collar and back grips (Brito, Aedo-Munoz and Miarka, 2020). The six guard position groups identified by Sacripanti (2021) shift systematically with relative height.

Posture (POS): upright (*shizentai*), mixed, or lowered (*jigotai*). These correspond to Sacripanti's (2021) three guard position types: normal, diagonal and curled-up, each associated with specific *kumi-kata* groups and attack patterns. *Jigotai* shortens the available lever arm for many techniques and forces the athlete to adapt. Figure 8 shows the three posture levels used in circuit station design.

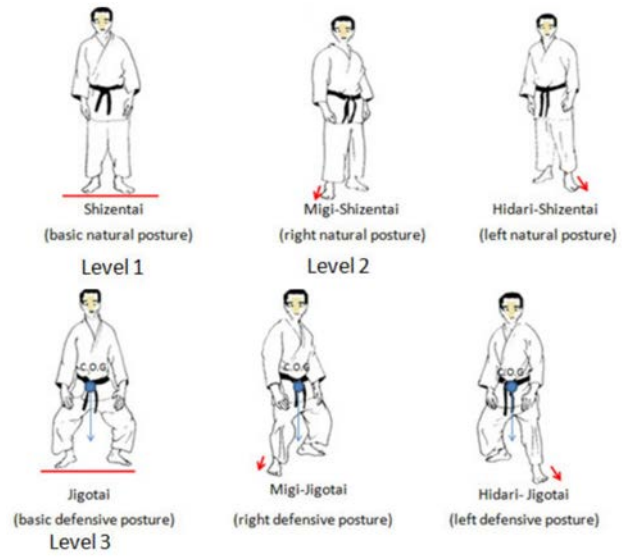

Figure 8. Posture factor levels for circuit station design: *shizentai, migi-shizentai*, and *jigotai* variants (Elalem, 2013, Figure 5.7a). Source: Author's MSc dissertation, Universita degli Studi di Roma 'Tor Vergata'.

Kumi-kata (KK): dominant sleeve-lapel, cross-grip, or over-the-back. Grip configuration is a decisive variable at elite level (Sacripanti, 2021; Adams, 1992). At the 2013 Rio World Championships Teddy Riner scored in three directions, *osoto-gari*, *o-uchi-gari*, and *uchi-mata*, from the same high right *kumi-kata*, showing how a single grip can support a complete attack system (Calmet and Pierantozzi, 2021).

Movement direction (MD): linear, lateral, or rotational. Elite *judoka* attack across six directions on average, with 80 percent direct attacks and 20 percent linked attacks (Calmet and Pierantozzi, 2021). Figure 9 shows the three movement direction levels. Couple techniques are executable across a wider range of velocities than lever techniques; lever techniques are mechanically favoured under low relative velocity conditions and face increasing execution difficulty as approach speed rises (Sacripanti, 2014).

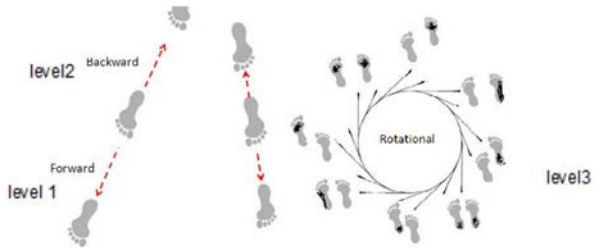

Figure 9. Movement direction factor levels: linear (forward/backward), lateral, and rotational (Elalem, 2013, Figure 5.9). Source: Author's MSc dissertation, Universita degli Studi di Roma 'Tor Vergata'.

Orthogonal Array Selection and Structure

With one two-level factor (FS) and four three-level factors (RH, POS, KK, MD), the L18 mixed-level orthogonal array is the correct selection (Taguchi, 1986; Elalem, 1995). It produces 18 station scenarios while ensuring that every combination of any two factors appears equally across the session. Table 1 shows the full array with factor levels expressed as station conditions.

The L18 was identified using Taguchi's standard array selector: one factor at 2 levels and four factors at 3 levels requires a minimum array of L18. Each factor is assigned to one column and the numerical level codes translate directly into the competitive conditions listed in Table 1.

Table 1. L18 Orthogonal Array: Technical-Tactical Circuit Station Scenarios

Station	Fighting Side	Relative Height	Posture	Kumi-kata	Movement Dir.
1	Right	Same height	*Shizentai*	Sleeve lapel	Linear
2	Right	Same height	Mixed	Cross-grip	Lateral
3	Right	Same height	*Jigotai*	Over-back	Rotational
4	Right	Shorter	*Shizentai*	Sleeve lapel	Lateral
5	Right	Shorter	Mixed	Cross-grip	Rotational
6	Right	Shorter	*Jigotai*	Over-back	Linear
7	Right	Taller	*Shizentai*	Cross-grip	Rotational
8	Right	Taller	Mixed	Over-back	Linear
9	Right	Taller	*Jigotai*	Sleeve lapel	Lateral
10	Left	Same height	*Shizentai*	Over-back	Rotational
11	Left	Same height	Mixed	Sleeve lapel	Linear
12	Left	Same height	*Jigotai*	Cross-grip	Lateral
13	Left	Shorter	*Shizentai*	Cross-grip	Linear
14	Left	Shorter	Mixed	Over-back	Lateral
15	Left	Shorter	*Jigotai*	Sleeve lapel	Rotational
16	Left	Taller	*Shizentai*	Over-back	Lateral
17	Left	Taller	Mixed	Sleeve lapel	Rotational
18	Left	Taller	*Jigotai*	Cross-grip	Linear

FS = Fighting Side; RH = Relative Height; POS = Posture; KK = *Kumi-kata*; MD = Movement Direction

Station 1 places the athlete against a same-height opponent in right stance, upright posture, sleeve-lapel grip, linear movement. Station 7 places the athlete against a taller opponent in left stance, upright posture, cross-grip, rotational movement. No two stations are the same and every constraint level appears six times across the 18 stations.

Table 2. Weight-Category Calibration: Recommended Constraint Adjustments by Category

Category	KK Priority	MD Priority	POS Emphasis	Technique Family Focus	Example Array Adjustment
Lightweight (<66 kg M; <57 kg F)	Cross-grip and sleeve (Levels 2+3 weighted 2:1 over Level 1)	Rotational increased to 40%; linear and lateral equal at 30% each	*Shizentai* dominant (60%); *jigotai* 20%; mixed 20%	Lever techniques at long distance (*to-ma-waza*); anticipatory entry emphasis	Assign Level 2 (cross-grip) to Columns 4+8 of L18; increase Level 3 (rotational) in column 5
Middleweight (66-100 kg M; 57-78 kg F)	Equal weighting across all three KK levels	Equal across linear, lateral, rotational (33% each)	Equal across all three posture levels (33% each)	Balanced; *renraku-waza* with direction changes	Standard L18 as published in Table 1; no column reweighting required
Heavyweight (>100 kg M; >78 kg F)	Over-back and collar grips (Levels 1+3 weighted 2:1 over Level 2)	Linear increased to 40%; lateral 35%; rotational 25%	*Jigotai* increased to 40%; mixed 35%; *shizentai* 25%	Couple techniques at short distance (*chi-ca-ma-waza*); defensive grip countering	Assign Level 3 (over-back) to columns 4+8; assign Level 3 (jigotai) to column 3 with higher frequency

KK = *Kumi-kata*; MD = Movement Direction; POS = Posture. Percentages refer to relative frequency of each factor level across the 18 stations. Standard L18 distributes each level equally (33%). Column adjustment refers to level-code assignment in the Taguchi array, not array structural modification.

Weight-Category Calibration

The constraint mix should reflect the athlete's weight category. Notational analysis of world-circuit contests confirms that tactical patterns differ substantially across categories (Lopez Diaz-de-Durana et al., 2018, and the calibration logic follows directly from the weight category profiles described in section 1. The mechanism for calibration is column reweighting, not array restructuring. The L18 array assigns each factor to a column; the coach decides which level codes in that column represent which competitive condition. For a lightweight athlete, assigning a cross-grip more frequently to the KK column means selecting a level-code pattern that repeats cross-grip nine times rather than six, reducing sleeve-lapel to three occurrences. For a heavyweight athlete, the same logic applies to over-the-back grip and *jigotai* posture. Table 2 shows this logic concretely by weight category.

Adjustments are made before the circuit is finalised for the training block, not session by session. The array structure itself does not change; only the assignment of level codes to competitive conditions changes.

Translation into Training Practice

Station Execution

Each station runs in two phases. The first is dynamic *uchi-komi*: repeated entry drills under the constraint conditions of that station's row, with *uke* giving controlled resistance to simulate contest conditions. The second phase is constrained *randori*: free practice within that station's scenario, with both partners holding their assigned constraint roles. The transition from *uchi-komi* to constrained *randori* is triggered when the athlete completes at least three consecutive circuit sessions with consistent, technically sound entries across all 18 stations, defined as no critical technical breakdown (failed *kuzushi*, collapsed *tsukuri*, or loss of constraint compliance) in more than 20 percent of attempts at any station. Coaches should document station-by-station completion quality across sessions before making the transition; individual athletes within the same group may progress at different rates. When relative height is a factor, three partners are needed. *Judoka* 1 is the shorter *uke* (level 1 of RH), *judoka* 2 is the same-height *uke* (level 2) and *judoka* 3 is the taller *uke* (level 3). Each *uke* moves to the station whose array row calls for their height level. Figure 10 shows this rotation for the linear station layout.

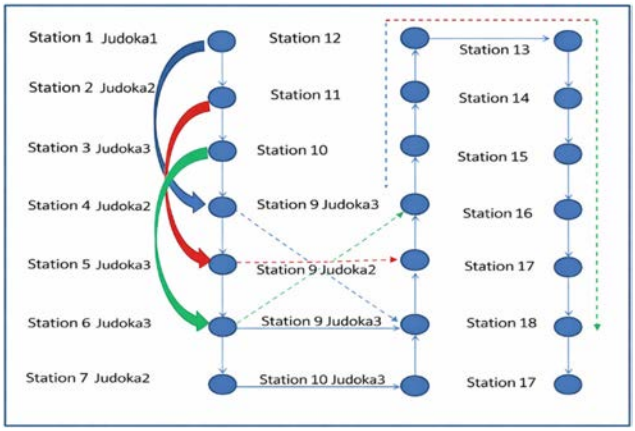

Figure 10. Linear station layout for the L18 circuit: *judoka* 1 (shorter), *judoka* 2 (same height) and *judoka* 3 (taller) rotate to stations that match their height level in the array (Elalem, 2013, Figure 5.10a). Source: Author's MSc dissertation, Universita degli Studi di Roma 'Tor Vergata'

Station time is three minutes. Recovery between stations is 1.5 minutes, used for coaching feedback. The timing for the full L18 circuit: 18 stations at 3 minutes = 54 minutes of practice time; 17 recovery intervals at 1.5 minutes = 26 minutes; total circuit time = 80 minutes. The 80-minute circuit sits inside a full 90- to 120-minute session; coaches should plan a warm-up (10 to 15 minutes) and cool-down (5 to 10 minutes) around it rather than treating circuit time as total session time (Elalem, 2013).

The station-level work:rest ratio of 2:1 (3 minutes work, 1.5 minutes recovery) describes the interval structure but does not reflect the distribution of high-intensity effort within each station. Inside each 3-minute block, attack executions average 1.86 ± 0.9 seconds and locomotion phases average 11.52 ± 6.1 seconds (Sacripanti and Ahmedov, 2021). The actual high-intensity work within each station is therefore considerably shorter than the station duration implies. This intermittent structure replicates the physiological demands of competition and stresses both the aerobic and anaerobic lactic systems across the full 80-minute session (Franchini, Giannini Artioli and Brito, 2013).

Uke fatigue is a practical constraint that coaches must plan for. With three partners rotating across 18 stations over 80 minutes, cumulative fatigue in later stations (approximately Stations 13 to 18) will degrade the quality of resistance *uke* can provide. Two mitigation strategies are available: rotating a fourth *uke* into the circuit at the midpoint to give each partner a recovery rotation, or scheduling a five-minute *uke* rest at the halfway mark without extending total session time. Either approach should be decided before the session and held constant across the training block so that station conditions remain comparable.

Coaching Role and Feedback

During circuit execution the coach observes and records errors against the specific station scenario in which they occur, not as general faults. This makes it possible to link each weakness to the constraint combination that exposed it. Within the 1.5-minute recovery, feedback should be limited to one or two correction points: the most critical error from that station and the target for the next attempt. More than this risks overloading the athlete before the next station begins.

When an error recurs across stations, the coach applies the Whole-Part-Whole method (Schmidt and Wrisberg, 2008; Mosston and Ashworth, 2002). The athlete works through the full attacking scenario first (Whole), then isolates the specific problem, whether *kuzushi*, *tsukuri*, or *kake*, for focused static or dynamic *uchi-komi* (Part), then returns to the full scenario (Whole). Figure 11 illustrates this method. Depending on the severity of the error, this cycle can be applied within a session or between sessions.

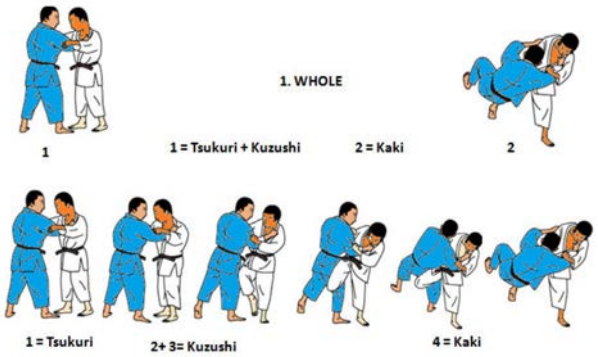

Figure 11. Application of the Whole-Part-Whole method to judo technique correction within circuit training (Elalem, 2013, Figure 5.3). Source: Author's MSc dissertation, Universita degli Studi di Roma 'Tor Vergata'

Feedback at the end of each station should focus on decision quality: was the technique selected appropriate for the movement direction and guard position, and was the entry timing right relative to the opponent's shifting velocity? Technical form is corrected only when it is preventing the decision from being executed. At elite level, most failures in competition come from the wrong decision or late timing, not from poor technique alone (Sacripanti, 2021; Calmet and Pierantozzi, 2021; Williams and Ericsson, 2005).

Periodisation Integration

The circuit fits into the double-periodisation model used in elite judo, which runs two preparation-competition cycles per year, aligned to continental and world championship calendars (Elalem, 2013).

In the preparation phase (six to eight weeks of high volume, low to moderate intensity), circuits run through dynamic *uchi-komi* with progressive increases in speed and resistance. The coach establishes consistent execution across all 18 scenarios and identifies which constraint combinations the athlete struggles with most.

In the competition phase (six to eight weeks of high intensity, reduced volume), stations are run as constrained *randori* at full speed. Contest analysis of upcoming opponents informs scenario weighting: if an opponent typically uses a cross-grip and lateral movement, those array levels can be emphasised in the session build-up.

In the transition phase (two to three weeks), intensity drops and Whole-Part-Whole correction targets errors from the preceding competition phase. *Kumi-kata* weaknesses are specifically addressed in this period, as Sacripanti (cited in Elalem, 2013) recommends correcting grip deficiencies during preparatory and transition phases rather than during competition phases.

Alignment with Long-Term Athlete Development

The OA-based circuit scales across the LTAD model as applied to judo (Balyi, Way and Higgs, 2013; Judo Canada, 2006). The LTAD principle that training content must match the athlete's developmental stage is respected by varying the array size and execution mode at each stage.

At the Learn to Train stage (males 9 to 12, females 8 to 11), the constraint space reduces to two or three factors using an L4 or L8 array, executed through static *uchi-komi*. This stage coincides with the peak window for skill and coordination development (Balyi, Way and Higgs, 2013). Introducing scenario variation here begins to build the perceptual sensitivity that will support tactical decision-making at later stages.

At the Train to Train stage (males 12 to 16, females 11 to 15), three factors use an L9 array, executed through dynamic *uchi-komi*. The circuit adds systematic technical variation alongside the aerobic and strength work appropriate to this stage.

At the Train to Compete stage (males 16 to 23, females 15 to 21), the full L18 applies, through dynamic *uchi-komi* progressing to constrained *randori*. The LTAD model prescribes 40 percent of time to technical-tactical development and conditioning, and 60 percent to competition and competition-specific training at this stage (Balyi, Way and Higgs, 2013). The OA-based circuit serves the technical-tactical portion of that 40 percent.

At the Train to Win stage (males 19 and above, females 18 and above), the circuit runs as *randori* only, with scenarios selected from contest analysis of specific upcoming opponents. Larger arrays (L27 or above) can be used where additional constraint combinations need coverage.

Proposed Outcome Measures for Future Experimental Validation

Important: The following outcome measures are proposed for future empirical validation and are not used in the present study. None of the measures described below have been collected, analysed or used to support any claim in this conceptual paper. They are defined operationally here so that researchers and practitioners can adopt them directly in future controlled trials evaluating the OA-based circuit framework.

Time to First Effective Attack (TFA). TFA is the elapsed time from the coach's start signal at each station to *tori*'s first technically sound attack attempt, measured by stopwatch or extracted from video. An attempt qualifies when two conditions are met: (1) the grip matches the station's KK level; and (2) *tori* initiates *tsukuri* with full body commitment, defined as *tori*'s centre of mass crossing inside *uke*'s base of support. Feints, incomplete entries and grip adjustments that do not meet condition (2) are not counted. TFA is averaged across repetitions and across all 18 stations.

Application example: At station 7 (right stance, taller *uke*, *shizentai*, cross-grip, rotational MD), the coach starts the timer at signal. *Tori* establishes the cross-grip (KK condition met), then initiates a rotational entry (condition 2 met) at 8.3 seconds. That is the TFA for that attempt at station 7. Averaged across three attempts and all 18 stations, TFA provides a session-level index of decision speed under varied constraint conditions. The normative reference is the 11.52 ± 6.1 second locomotive phase reported by Sacripanti and Ahmedov (2021); TFA values consistently below this threshold suggest the athlete is reading constraints and committing to attack within normal contest windows.

Preliminary reliability guidance: TFA measured from video has high inter-rater reliability when the two qualifying conditions are operationally defined in advance (expected ICC > 0.90 based on stopwatch studies in similar sports; Nevill and Atkinson, 1997). Stopwatch measurement by a single coach introduces timing error of approximately ±0.3 seconds and should be acknowledged in any publication using TFA as a primary outcome.

Effective Attack Rate (EAR). EAR is the proportion of qualifying attack attempts (any movement meeting condition (2) above) that would receive a referee score (*waza-ari or ippon*) under current IJF rules (IJF, 2023). A scoring attempt is one assessed by the coach as meeting IJF scoring criteria: *Uke* projected with control, speed, and force onto the back. EAR = scoring attempts / total attempts per station, expressed as a percentage. At least three attack sequences per station are needed for a stable estimate.

Application example: In a full L18 circuit session, *tori* makes 54 qualifying attempts across all 18 stations (average three per station). The coach assesses 8 as scoring. EAR = 8/54 = 14.8 percent. Elite competition scoring rates of 11 to 12 percent (Calmet and Pierantozzi, 2021) serve as a contextual reference only; those figures reflect full-resistance contest conditions, and training EAR under constrained *randori* is expected to exceed that baseline. Coaches should establish institution-specific norms before drawing comparisons to competition data.

Preliminary reliability guidance: EAR requires subjective judgement on IJF scoring criteria. A second observer should verify ratings using a sample video session before data collection begins. Expected inter-rater agreement for dichotomous scoring decisions in judo is moderate to good (kappa approximately 0.65 to 0.80) when observers are trained on current IJF video examples (Heinisch and Busch, 2013). Coaches without recent referee training should complete a calibration session using competition footage before applying EAR in a research context.

Decision Accuracy (DA). DA assesses whether *tori*'s technique selection matches the biomechanical conditions of the station. The coach scores two independent items after each attack sequence.

Item 1 (technique family): Was the technique family (couple or lever) appropriate for the station's shifting velocity level? At high velocity (MD: rotational), couple techniques are correct because lever techniques are mechanically favoured only under low relative velocity conditions (Sacripanti, 2014). Score: 0 = wrong family; 1 = correct family with hesitation or incomplete execution; 2 = correct family selected and executed with commitment.

Item 2 (Attack Distance Class): Was the distance category of the attack (*chika-ma*, *ma*, or *to-ma*) consistent with the opponent's guard position? Score: 0 = distance category incompatible with guard position; 1 = compatible but *tori* adjusted late; 2 = compatible and executed at the first opportunity.

Each station receives a DA score from 0 to 4, producing a session maximum of 72 across 18 stations. DA is reported as a proportion of session maximum (score / 72) to allow comparison across sessions and athletes. Scoring the two items separately provides diagnostic specificity: an athlete who consistently scores 2 on item 1 but 0 on item 2 has a distance-reading problem, not a technique-family problem.

Application example: In station 3 (right stance, same height, jigotai, over-back grip, rotational MD), *tori* attempts a *tai-otoshi* (lever technique). Item 1 score = 0 (wrong family for rotational MD; a couple technique was required). Item 2 score = 1 (*tori* adjusted to medium distance, which is compatible with jigotai, but late). Station DA = 0 + 1 = 1 / 4 possible. Across the full session, low scores consistently on item 1 in rotational stations indicate a specific knowledge gap in the couple/lever decision rule.

Preliminary reliability guidance: DA requires coaches to be familiar with Sacripanti's (1987, 2021) biomechanical classification. Calibration using video examples is necessary before data collection. Expected inter-rater reliability for the two-item rubric, when both observers have completed calibration, is good (ICC approximately 0.75 to 0.85 for similar structured observation rubrics in combat sports; James, Taylor and Stanley, 2007). Without calibration, reliability is likely to be poor.

Rate of Force Development (RFD) as a physical readiness index. RFD is among the most diagnostically useful biomechanical variables for monitoring physical readiness to execute high-power techniques at competition intensity (Franchini, Del Vecchio and Matsushigue, 2011; McLellan, Lovell and Gass, 2011). Grip strength, isometric pulling force and reactive strength index are also established indicators of judo performance capacity and should be tracked alongside RFD where resources allow.

Where a force platform is available, RFD is measured via counter-movement jump (CMJ) protocol at the start and end of each preparation phase. Where a force platform is not available, the difference between squat jump (SJ) and CMJ heights, measured on a contact mat or validated jump app, provides a field-based proxy for reactive strength relevant to throwing power (Monteiro et al., 2011). RFD data should be collected at the same point in the weekly cycle to control for fatigue effects.

Application example: At the start of a six-week preparation phase, a 78 kg *judoka* produces a CMJ height of 38 cm and an SJ height of 33 cm (CMJ-SJ difference = 5 cm). At the end of the phase, CMJ = 41 cm, SJ = 35 cm (difference = 6 cm). The increase in CMJ-SJ difference reflects improved reactive strength contribution, which is relevant to the explosive *kake* phase of throwing. A decrease in this difference alongside stable CMJ would suggest fatigue or reduced elastic energy utilisation and should prompt load reduction before competition.

Practical Implications

The OA-based circuit changes what circuit training, a general sport conditioning tool, does when applied to judo preparation, without removing its conditioning function. Dynamic *uchi-komi* and constrained *randori* are high-intensity activities in their own right. The alternation of approach sequences and attack executions within each station trains both the aerobic and anaerobic lactic systems while also developing tactical decision-making (Franchini, Giannini Artioli and Brito, 2013). Coaches do not need to choose between conditioning and tactical preparation.

Building stations around guard positions, general action invariants, and shifting velocity rather than named technique sequences gives the athlete more options at the *kake* stage than a traditional *renraku-waza* circuit does (Sacripanti, 2014, 2016). In a classic combination circuit, tori enters *kake* committed to technique A, then moves to technique B if A fails. In the biomechanical circuit, the same general action invariant entry keeps multiple technique options open and the athlete selects based on what the opponent's position allows at that moment (Elalem, 2013; Sacripanti, 2014). An opponent cannot read a committed technique sequence because there are none.

Gender and weight category should shape scenario weighting. Men score in more directional sectors than women on average (2.8 ± 0.9 versus 2.2 ± 1.1; $p = 0.004$), so gender-specific circuits should weight movement direction levels differently (Calmet and Pierantozzi, 2021). The weight-category calibration in Table 2 provides the practical basis for these adjustments.

When athletes discover non-classical grip positions, throwing trajectories, or directional variants during circuit practice at high shifting velocity, these should be documented and developed rather than corrected back to classical form. Sacripanti (2021) calls these henka throws. They are technically valid innovations that emerge from real constraint interactions, and they deserve the same coaching attention as any established technique.

CONCLUSION

Technical-tactical expertise in judo is built through repeated interaction with the constraints that define the decision problem in competition: grip configuration, opponent posture and height, movement direction, and the mechanical conditions at the moment of entry. A training session that fixes those constraints gives athletes only a fraction of the preparation they need, regardless of how many repetitions are performed.

By treating each circuit station as a row in a Taguchi orthogonal array, coaches can guarantee balanced exposure to competitive constraint combinations within a standard 80-minute session, without adding training time or redesigning the session structure. The five-factor L18 design covers the most influential constraints on technique selection identified in competition research. It scales from a simplified L4 for younger athletes to the full L18 for elite competitors, integrates with both traditional *renraku-waza* approaches and the biomechanical approach based on guard positions and general action invariants, and fits within the 40:60 training-to-competition ratio prescribed for elite development by the LTAD model.

The paradigm's ecological validity rests on two foundations: the five constraints are drawn from published contest analysis and biomechanical classification data, and the relationship between guard position, shifting velocity and technique family is grounded in Sacripanti's classification framework, verified against Olympic Games and world championship data (Sterkowicz, Sacripanti and Sterkowicz-Przybycien, 2013; Sacripanti and Ahmedov, 2021).

Future research should compare athletes trained with and without the OA-based circuit across TFA, EAR, DA, and competition performance over a full preparation-competition cycle. Combined *tachi-waza* and *ne-waza* circuit designs and athlete-specific arrays built from individual contest analysis data, are natural extensions. The paradigm is also transferable to other combat sports such as wrestling and Brazilian jiu-jitsu, where decision-making is shaped by opponent interaction in the same way.

LIMITATIONS

Six limitations of this conceptual study should be acknowledged.

First, the five constraints selected for the L18 array are grounded in published competition data but have not been validated empirically as a combined set. The relative contribution of each constraint to decision-making outcomes in judo remains to be quantified.

Second, the proposed outcome measures (TFA, EAR, DA) have not been tested for inter-rater reliability in a judo coaching context. A dedicated reliability study is a necessary precondition for their adoption in research settings.

Third, the framework assumes that athletes have established stable mechanical patterns in core techniques. It is not appropriate for beginners who have not yet developed the technical base required to benefit from scenario variation.

Fourth, the logistical demands of the full L18 circuit are non-trivial. Three partners are required for relative height variation, and their rotation across 18 stations requires advanced planning and a *tatami* space sufficient to run all stations simultaneously. Smaller training groups or limited mat space may need to use a simplified L9 array with fewer stations or run the circuit across two sessions.

Fifth, cognitive overload is a real risk for younger athletes. The L18 circuit presents 18 distinct constraint combinations and athletes at the Learn to Train or Train to Train stage may struggle to maintain constraint compliance while also executing well technically. For these stages, the L4 or L9 arrays are strongly recommended and coaches should introduce additional constraints incrementally rather than all at once.

Sixth, implementing the full circuit correctly requires coaches to understand both the orthogonal array logic (which factor goes in which column and how to apply calibration adjustments) and the Sacripanti (1987, 2021) biomechanical classification (which is needed to apply the DA rubric). Coaches without background knowledge in these areas will need a structured orientation before their first use. The framework should be delivered through coach education programmes rather than being distributed as a standalone tool.

This paradigm rests on the argument that systematic organisation of competitive constraints, rather than increased training volume or repetition, is the primary driver of decision-making expertise in elite judo, a hypothesis that the proposed outcome measures will allow future research to test directly.

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Judo as a Pedagogical Tool for ADHD: A Neurobiological Perspective on Dopamine and Noradrenaline Regulation

By Alessia Ritieni

Abstract: *Attention Deficit Hyperactivity Disorder (ADHD) is associated with dysregulation in dopaminergic and noradrenergic systems, affecting attention, motivation and behavioural control. Physical activity influences these neurochemical systems, particularly when structured and goal orientated. This paper presents a conceptual analysis integrating neuroscientific and pedagogical literature to explore how judo may support neurobiological regulation in individuals with ADHD. Judo is characterised by structured practice, progressive skill development and continuous feedback. It may contribute to improved attention regulation through reward-based learning, optimal arousal modulation and embodied engagement. Specific pedagogical strategies for coaches are outlined, including providing positive feedback, planning a dynamic and stimulating lesson and modulating tone of voice. While causal evidence remains limited, this framework supports judo as a promising complementary intervention.*

Keywords: *ADHD; Neurodivergence; Dopamine; Noradrenaline; Pedagogy*

ADHD is characterised by persistent patterns of inattention, impulsivity and hyperactivity linked to dysregulation of dopamine and noradrenaline systems, particularly within prefrontal cortical networks (Arnsten, 2009). These imbalances affect executive functions such as attention control, inhibition and goal-directed behaviour.

Physical activity is associated with improvements in cognitive performance, but structured and engaging activities appear especially effective. Judo represents a unique pedagogical context combining structure, ritual, social interaction and progressive learning (Kano, 1986). This paper explores how these characteristics align with neurobiological mechanisms relevant to ADHD.

Methodological Approach

This paper adopts a conceptual integrative approach, synthesising literature from neuroscience, exercise science and pedagogy to develop a theoretical framework linking judo and neuroregulation. For this research, scientific literature of the past 20 years has been examined and selected from neurosciences, psychology and sport pedagogy.

ADHD and Neurochemical Regulation

Attention-Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder defined by a persistent pattern of inattention and/or hyperactivity and impulsivity that interfere with functioning or development. Symptoms include difficulties in sustaining attention, disorganisation, excessive motor activity and impulsive behaviour inappropriate to the developmental level. These manifestations must be present across multiple settings (e.g., home, school or work), have an onset in childhood and lead to clinically significant impairment in social, academic or occupational functioning. ADHD is associated with deficits in executive functioning, including inhibitory control, working memory and cognitive flexibility, and often co-occurs with other psychiatric or learning disorders (American Psychiatric Association, 2013).

ADHD and Neurotransmitters

Contemporary research highlights that ADHD is strongly linked to dysfunctions in brain networks involving the prefrontal cortex, basal ganglia and cerebellum (Teleanu et al. 2022). The prefrontal cortex plays a central role in executive functions such as attention control, inhibition, planning and working memory. In individuals with ADHD, this region often shows reduced activation and inefficient regulation (Teleanu et al., 2022).

The central nervous system (CNS) processes information from and delivers information to the peripheral nervous system through signal conduction from one neuron to another via synapses. An essential role in information transmission throughout the CNS and peripheral nervous system is played by neurotransmitters (NTs), which are endogenous chemical messengers that carry and amplify nerve-to-nerve signaling or signals between nerves and other cell types (Popova, 2022).

Dopamine and Noradrenaline: Function and Role

Two of the most important neurotransmitters in ADHD are Dopamine and Noradrenaline. Dopamine is essential for reinforcement learning. It signals reward prediction errors, helping individuals learn from outcomes. In ADHD, this signalling is altered, making it harder to maintain motivation without immediate feedback. (Del Campo et al., 2011). Noradrenaline modulates attention and vigilance. It helps filter relevant from irrelevant stimuli. In ADHD, this filtering mechanism is less efficient, contributing to distractibility.

Dopaminergic dysfunction is a key feature of ADHD. Dopamine pathways, particularly the mesocortical and mesolimbic systems, are involved in reward processing and motivation. Reduced dopamine availability leads to difficulties in sustaining effort, delayed gratification and goal-directed behaviour (Schultz, 2016). Noradrenergic systems, originating primarily from the locus coeruleus, regulate arousal and attention. Dysregulation in this system results in fluctuating alertness, distractibility and inconsistent cognitive performance (Del Campo et al., 2011). The interaction between dopamine and noradrenaline is crucial. Both neurotransmitters follow an inverted-U relationship, meaning that both low and high levels impair cognitive functioning, while optimal levels enhance performance (Levi, 2009).

Dopamine and noradrenaline play a central role in attention, motivation and executive functioning. Dysfunctions in these systems are associated with difficulties in focus and behavioural control (Volkow et al., 2009; Del Campo et al., 2011).

Physical Activity and Neurotransmitter Regulation

Physical exercise has been shown to increase dopamine and noradrenaline levels and improve cognitive performance (Meeusen & De Meirleir, 1995; Dishman et al., 2006). Structured activities appear to produce stronger regulatory effects (Best, 2010). Practising a sport can help people with ADHD to self-regulate their attention and channel their energy (Meeusen & De Meirleir, 1995).

Judo as a Pedagogical Environment

Judo training is highly structured and ritualised, providing predictable routines and continuous feedback. These features may support attention, discipline and behavioural regulation (Lakes& Hoyt, 2004). Compared to many sports, it offers individual interaction and clear progression systems.

Dopamine and Noradrenaline Regulation Through Judo

Judo supports dopaminergic activity through reward-based learning, intrinsic motivation and skill progression (Wise, 2004: Lakes & Hoy, 2004).

Alternating phases of activation and control support optimal arousal regulation (Arnsten, 2009); this is a huge way to regulate noradrenaline and help the athlete to stay focused longer.

The practice of judo represents a complex behavioural paradigm that integrates physical exertion, motor co-ordination and adaptive cognitive engagement, thereby influencing catecholaminergic regulation at multiple levels. In particular, dopamine (DA) and noradrenaline (NA) systems (central to motivation, attention and executive functioning) appear to be modulated through both acute and long-term mechanisms associated with structured martial arts training.

From an acute perspective, judo is characterised by intermittent high-intensity activity, which activates the sympathetic nervous system and promotes increased catecholamine synthesis and release. This results in elevated levels of DA within mesocorticolimbic and nigrostriatal pathways, supporting reward processing, motor initiation and reinforcement learning. Simultaneously, increased NA release from the locus coeruleus enhances cortical arousal and attentional selectivity by improving the signal-to-noise ratio in prefrontal networks (Meeusen & De Meirleir, 1995; Dishman et al., 2006). These transient neurochemical changes may contribute to immediate improvements in cognitive performance and behavioural regulation.

Beyond these short-term effects, repeated exposure to judo training induces experience-dependent neuroplasticity. Chronic engagement in physically and cognitively demanding activities has been associated with increased dopaminergic receptor availability, particularly within the striatum, as well as enhanced noradrenergic modulation of prefrontal circuits (Voss et al., 2013; Robertson et al., 2016). These adaptations are thought to be mediated by neurotrophic factors such as brain-derived neurotrophic factor (BDNF), which facilitates synaptic plasticity and strengthens fronto-striatal connectivity. As a result, individuals may exhibit improved executive functions, including working memory, inhibitory control and cognitive flexibility.

A distinctive feature of judo lies in its reliance on continuous interaction with an unpredictable opponent, requiring rapid motor planning, error correction and strategic decision-making. This context strongly engages dopaminergic mechanisms involved in reward prediction error signalling, whereby discrepancies between expected and actual outcomes guide behaviorual optimisation (Schultz, 2016). Each successful or unsuccessful action generates feedback that refines motor and cognitive strategies, reinforcing efficient patterns through phasic dopamine activity.

In parallel, the attentional demands inherent in judo practice recruit the locus coeruleus–noradrenergic system, which regulates arousal according to an inverted-U function, optimising performance at intermediate levels of activation (Aston-Jones & Cohen, 2005). Through repeated exposure to such conditions, practitioners may develop improved baseline regulation of arousal and attention, reducing variability in cognitive performance. (Wise, 2004)

Taken together, these findings suggest that judo constitutes a multi-modal intervention capable of synchronously modulating dopaminergic and noradrenergic systems through the integration of physical, cognitive and affective processes. This integrated regulation may be particularly relevant in conditions characterised by catecholaminergic dysregulation, such as Attention-Deficit Hyperactivity Disorder, where both DA and NA pathways play a central role in symptom expression and functional outcomes.

Practical Pedagogical Strategies for Coaches

Children with ADHD benefit from reinforcement across multiple time scales. Immediate positive feedback enhances engagement, medium-term reinforcement (e.g., session goals) sustains motivation and long-term reinforcement (e.g., belt progression) supports persistence and identity development.

Sessions should be structured in short, clearly defined blocks to maintain attention and avoid overload. Activities should balance technical learning and engagement, incorporating playful elements, mini-challenges and game-based tasks to stimulate motivation. Instructions should be clear, concise and delivered one at a time to reduce cognitive load. Coaches should use a calm but dynamic tone of voice, adapting rhythm and pace to maintain attention without overstimulation. Predictable routines, consistent cues and rhythmic instruction support attentional regulation. Motivation should be reinforced through encouragement, recognition of effort and achievable challenges. Emotional regulation should be supported by maintaining a positive climate, limiting excessive pressure and helping children manage frustration during practice and competition.

Conclusion and Limitations

Judo offers a structured pedagogical framework that integrates physical activity, discipline and social interaction. It may support the regulation of dopamine and noradrenaline, contributing to improved attention and behavioural control. Coaches can support athletes with ADHD by adapting judo sessions to create a positive and structured environment, avoiding overstimulation, maintaining motivation and organising lessons into short, engaging and clearly defined blocks.

This article is conceptual in nature and does not include empirical data. While it is grounded in existing neuroscientific and pedagogical literature, the proposed relationships between judo practice and neurochemical regulation should be interpreted with caution.

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Post-Olympic Patterns in Elite Judo Senior World Championships 2022–2025 and the EJU Case

By Ivo Ricardo Dias Rosa

Abstract: *Elite judo performance is shaped by cyclical participation, federation engagement and institutional mechanisms such as the World Ranking List (WRL) and seeding. This paper synthesises 2022-2025 trends, using the 2025 Senior World Championships in Budapest as a post-Olympic case. The European Judo Union (EJU) Report 2025 is the primary evidence base, with IJF/Judobase event pages used for official verification. We apply descriptive trend analysis and comparative interpretation to examine participation and gender structure, EJU representation, continental medal balance, age profiles, seeded-to-medal conversion, and Mixed Team engagement. Overall participation contracted from 658 athletes in 2024 to 556 in 2025 after stability in 2023-2024, consistent with a post-Olympic transition signature. The EJU athlete share remained stable at 50-52% from 2022-2025, but the number of nations represented fell from 107 in 2024 to 93 in 2025. Competitive balance tightened: medal-winning federations decreased from 25 to 20, while Asia increased from 22 medals in 2024 to 25 in 2025 and Europe retained a narrow lead with 28 medals (50%). Seeding strongly predicted podium outcomes, but the men's -73 kg and women's -63 kg categories remained most open (50% seeded-to-medal rates). Age signals were uneven, including younger male medallist pockets at -81 kg (23.95 years) and -100 kg (24.78 years), and very young women's +78 kg medallists (22.87 years). The paper concludes with six recommendations for post-Olympic stabilisation, category-specific transition programming, WRL-informed planning, mixed team incentives, and annual monitoring.*

Keywords: *performance analytics; federation representation; World Ranking List; medal concentration; athlete renewal; sport policyattention deficit hyperactivity disorder*

Senior world championships provide a high-resolution view of the international judo ecosystem. They reflect the depth of national programmes, the readiness of athlete pipelines and the competitive constraints created by qualification and ranking systems. While Olympic outcomes often dominate public narratives, the immediate post-Olympic year can reveal structural signals that are less visible during the peak of Olympic qualification: who sustains participation when Olympic selection pressure recedes, which federations can renew talent without performance collapse, and where competitive balance shifts as athletes retire, reduce competition volume, or re-enter international circuits (European Judo Union, 2025).

The 2025 World Championships Hungary in Budapest occurred directly after the Paris 2024 Olympic cycle. The EJU Report 2025 describes the reduction in athlete participation in 2025 as reflecting a typical post-Olympic transition pattern (European Judo Union, 2025). The analytical task is therefore not simply to record that participation fell but to identify the signature of the contraction: whether it is symmetrical across men and women, whether it disproportionately affects the number of participating nations and whether it alters the distribution of performance outcomes.

A performance-system perspective requires attention to participation ecology. Participation totals capture the scale of the competitive field, but representation captures breadth. A field of similar size can be composed of many nations with small delegations or fewer nations with large delegations. These configurations are not equivalent for competitive diversity or development opportunity. For continental unions and federations, representation is a governance-relevant outcome because it relates to inclusion, pathway accessibility and the feasibility of sustaining competitive depth across weight categories.

Competitive balance in judo can be described at multiple levels. At the macro level, medal distribution by continental union signals relative strength across regions. At the meso level, the number of medal-winning federations indicates whether medals are dispersed across many programmes or concentrated in a smaller set. At the micro level, the internal structure of medal success matters: a region can lead in total medals while relying on one dominant nation, or it can achieve strength through distributed

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success across multiple nations. The EJU Report 2025 explicitly contrasts Japan's sustained gold dominance with the EJU bloc's broad and collective strength (European Judo Union, 2025).

Institutional mechanisms also shape performance outcomes. The World Ranking List (WRL) and seeding structure bracket formation and, in turn, the probability that high-ranked athletes convert ranking to medals. The IJF Sport and Organisation Rules (SOR) provide the normative framework for IJF competition organisation and terminology, while recent predictive work shows that the IJF World Ranking List (WRL) can contribute to forecasting Olympic medal outcomes (Guilheiro & Franchini, 2024; International Judo Federation, 2025). From an analytics standpoint, seeded-to-medal conversion provides a practical indicator of how strongly rankings translate to podium outcomes, and where systematic 'openings' exist for lower-ranked athletes (European Judo Union, 2025).

Finally, post-Olympic periods are frequently associated with renewal. In judo, renewal can be observed through age profiles of participants and medallists and through category-specific patterns where younger athletes emerge or veteran athletes continue to dominate. Because weight categories differ in depth, tactical styles and physical demands, renewal is expected to be uneven rather than uniform. EJU Report 2025 provides aggregated age indicators that allow an initial mapping of these renewal pockets (European Judo Union, 2025).

This paper addresses a practical gap: few performance-analytics articles synthesise participation, representation, competitive balance, age structure, and ranking effects as a joined system across multiple consecutive world championship editions. Existing judo research has examined contest outcomes and scores/penalties (Dopico-Calvo et al., 2023; Kons et al., 2018), category-specific penalties (Kajmovic et al., 2022), gripping and time-motion profiles by sex and weight category (Soriano et al., 2019), and women's ippon techniques at Olympic level (Ojeda-Aravena et al., 2025). Those studies remain important for contest-level performance, but federation planning and policy decisions also require system-level, multi-year signals. Using EJU Report 2025 as primary evidence, this paper provides a descriptive synthesis that prioritises pattern signatures relevant to programme design (European Judo Union, 2025).

The manuscript is guided by the following research questions: (i) What are the post-Olympic cycle signatures in participation volume, national representation and gender structure? (ii) How is competitive balance evolving across continental unions and within the EJU bloc, as reflected in medal distribution and dispersion? (iii) How strong is WRL/seeding as a predictor of podium outcomes, and where do systematic openings appear? (iv) What policy and programme implications follow for federation support, transition programming, and monitoring?

DATA AND METHODS

This manuscript is a secondary analysis grounded in the EJU's World Championships Senior 2025 - Budapest, HUN: EJU Report 2025 (Sport Matters), produced by the EJU Sport Sector and published in June/July 2025 (European Judo Union, 2025). The base document reports aggregated indicators for the World Senior Championships 2025 (Budapest; individual event 13th-19th June 2025) and the Mixed Team event (20th June 2025), and includes comparisons with previous editions (European Judo Union, 2025).

The EJU report was treated as the primary analytical source. IJF.org event pages and IJF Judobase were used as official verification sources for event-level totals and competition records: the 2025 individual event page reports 556 competitors from 93 countries (294 men and 262 women), and the mixed team page reports 172 competitors from 16 countries (International Judo Federation, n.d.-b, n.d.-c). Judobase is cited as a dynamic IJF database because it states that its data covers all official senior IJF competitions since 1st January 2009 (International Judo Federation, n.d.-a).

The analytic scope is therefore defined by the report's aggregated measures. We do not access athlete-level contest data, technical-scoring breakdowns or micro-level competition logs. Consequently, the analysis is descriptive and interpretive. Where mechanisms are discussed (e.g., 'post-Olympic adjustment', 'core-periphery dynamics', 'opening zones'), they are presented as plausible interpretations consistent with observed patterns rather than as causal claims.

Measures were selected to align with the paper's dual lens: performance analytics (trends and patterns) and policy or programme implications (actionable recommendations). The primary indicators were: total participation and gender split (2022-2025); EJU athlete share overall and by sex where reported; number of participating nations and proportion of EJU nations; medal distribution by continent and by gender where reported; number of medal-winning federations; WRL/seeding impact assessed as seeded-to-medal conversion by weight category; age profiles of participants and medallists by sex and category; and Mixed Team participation counts (teams/NFs, athletes, EJU participation) (European Judo Union, 2025).

Derived values were computed from reported counts, such as year-on-year percentage changes in participation (Table 1). All derived calculations are transparent and reproducible from the counts presented in the report. No imputation was performed for missing values; where the report did not provide a value in the extract used here, it is marked as not reported. The analysis is therefore conservative in the sense that it avoids filling data gaps with assumptions.

A classification caveat is central to interpretation. The EJU report notes that athletes from Russia who participated under the IJF flag were considered associates of the EJU, and the IRT was classified as IJF (European Judo Union, 2025). This affects the interpretation of EJU/IJF shares and may shape how medals are attributed in continental or organisational comparisons. In this manuscript, we follow the report's classification when summarising EJU representation and medal patterns, and we explicitly restate the caveat when interpreting EJU shares.

Japanese judo terms follow the IJF SOR glossary and are italicised throughout the manuscript, consistent with the journal guidance and the SOR reference to the glossary of Japanese terms (International Judo Federation, 2025).

The analytic approach combines three steps. First, descriptive trend analysis summarises year-to-year changes and identifies discontinuities that coincide with the post-Olympic transition. Second, comparative interpretation contrasts 2024 and 2025 outcomes for competitive balance and seeding predictability, highlighting shifts in concentration and 'openness'. Third, pattern identification integrates multiple indicators into a small set of narratives that can support programme decisions. The goal is to produce a coherent, evidence-led synthesis rather than an exhaustive enumeration of statistics.

The evidence base combines the EJU report with official IJF verification pages and a targeted set of peer-reviewed judo and sport-policy studies. External sources are used to support contextual framing, terminology, methodological positioning and programme implications; the numerical trend analysis remains anchored in the EJU report and official IJF event records.

RESULTS: TRENDS AND PATTERNS

Post-Olympic contraction and gender stability

The most visible signature in 2025 is the contraction in overall participation after two stable years. Total athlete participation grew from 571 in 2022 to 657 in 2023 and remained essentially stable in 2024 (658), before dropping to 556 in 2025 (European Judo Union, 2025). This pattern is explicitly described in the base report as reflecting a typical post-Olympic Games transition (European Judo Union, 2025).

The contraction is broad-based across men's and women's divisions. Men's participation rose from 310 (2022) to 343 (2023) and 349 (2024), then fell to 294 in 2025, representing a 16% reduction relative to 2024 (European Judo Union, 2025). Women's participation rose from 261 (2022) to 314 (2023), stabilised at 309 (2024) and fell to 262 in 2025 (a 15% drop), returning to values close to 2022 (European Judo Union, 2025). Table 1 reports these counts and derives year-on-year changes.

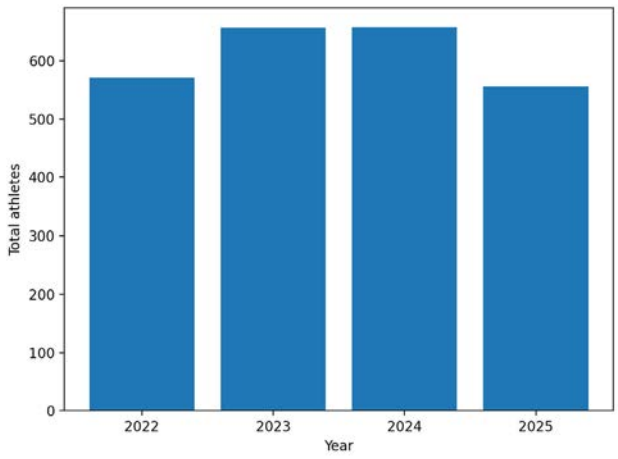
Table 1. Participation trend (2022-2025): Total, Men, Women, and YoY % change.

Year	Total athletes	YoY % (Total)	Men	YoY % (Men)	Women / YoY % (Women)
2022	571	-	310	-	261 / -
2023	657	+15.1%	343	+10.6%	314 / +20.3%
2024	658	+0.2%	349	+1.7%	309 / -1.6%
2025	556	-15.5%	294	-15.8%	262 / -15.2%

Source: European Judo Union (2025), EJU Report 2025; individual event totals cross-checked with the International Judo Federation (n.d.-b).

From a performance-analytics perspective, the crux is that the post-Olympic contraction does not appear to be gender-skewed in magnitude: men and women contract by approximately the same proportion. This supports a 'scale' interpretation (a smaller overall field) more than a 'reallocation' interpretation (one sex disengaging disproportionately).

Gender distribution is described as stable, with female participation varying around 49-52% in recent years (European Judo Union, 2025). Notably, the proportion of women within the EJU cohort increased to 52% in 2025, which the report interprets as a positive indicator of gender equality in the EJU system (European Judo Union, 2025). For federation planning, stability through contraction is meaningful: it suggests that women's participation is not more fragile than men's in the immediate post-Olympic year, and that gender-equity gains can be sustained even when overall entries decrease.



Source: European Judo Union (2025), EJU Report 2025; individual event totals cross-checked with the International Judo Federation (n.d.-b).

Figure 1. Total athlete participation (2022-2025) highlighting post-Olympic contraction.

Figure 1 visualises the total participation trend across 2022-2025 and makes the 2025 step-change salient. In practical terms, a smaller field can change the competitive environment: bracket density, ranking-point competition, and the number of nations present all interact with how 'open' categories feel to athletes and coaches. Although such mechanisms cannot be tested here, the empirical signature is clear: 2025 is discontinuous relative to 2023-2024 in participation volume (European Judo Union, 2025).

Stable EJU athlete share vs shifting federation participation

A second pattern is the stability of EJU representation in the athlete pool. The EJU athlete share remains consistent across 2022-2025: 51% (2022), 50% (2023), 51% (2024), and 52% (2025) (European Judo Union, 2025). The report further differentiates this by sex, noting that EJU men were 52% in 2022, dipped to 50% in 2023 and returned to 52% in 2024-2025, while EJU women rose to 52% in 2025 after a dip in 2023 (European Judo Union, 2025).

Stability in athlete share, however, does not imply stability in federation breadth. The number of participating nations increased from 82 (2022) to 107 (2024) and then dropped to 93 in 2025 (European Judo Union, 2025). The percentage of EJU nations among participating nations fell from 43% (2022) to 36% (2024), recovering slightly to 38% in 2025 but still below the 2022 figure (European Judo Union, 2025). Table 2 summarises these representation indicators.

Table 2. EJU representation: athlete share (2022-2025) and % EJU in nations (2022-2025).

Year	EJU athlete share of all athletes	% EJU in participating nations
2022	51%	43%
2023	50%	39%
2024	51%	36%
2025	52%	38%

Source: European Judo Union (2025), EJU Report 2025.

Together these indicators support a core-periphery interpretation. The 'core' (in the sense of bloc-level athlete presence) remains stable for the EJU even as the overall field contracts. The 'periphery' (in the sense of the breadth of national representation) appears more volatile in the post-Olympic year. The base report explicitly links the decline in proportional representation of EJU nations to the need for specific programmes for smaller or emerging EJU countries to maintain participation beyond Olympic qualification years (European Judo Union, 2025).

From a policy standpoint, this distinction matters because athlete share can mask internal concentration. A stable bloc share can coexist with fewer member federations contributing those athletes. For performance development, sustaining federation breadth is important strategically: it supports a wider talent base, more diverse training environments, and a broader competitive 'market' within Europe. The post-Olympic drop in participating nations suggests that support mechanisms may be most needed precisely when qualification pressure is lower and budgets are being reset for a new cycle.

The classification caveat concerning Russian athletes under the IJF flag being treated as EJU associates should also be acknowledged when interpreting EJU representation. While the stable EJU share is robust as reported, the precise distribution of 'EJU vs IJF' can be sensitive to classification rules. The key point for this manuscript is transparency: interpretations follow the report's classification and restate it where relevant (EJU, 2025).

Competitive balance: continent shifts and concentration of medal-winning federations

Competitive balance in 2025 shows two simultaneous movements: a modest shift in continental medal shares and increased concentration of medal success across fewer federations. At the continental level, Europe (EJU) leads with 28 medals (50%) in 2025, down from 31 medals (55%) in 2024 (European Judo Union, 2025). Asia (JUA) rises to 25 medals (45%) from 22 in 2024, while the Americas (PJC) remain stable at 3 medals (5%) (European Judo Union, 2025). Figure 2 presents the 2024-2025 comparison.

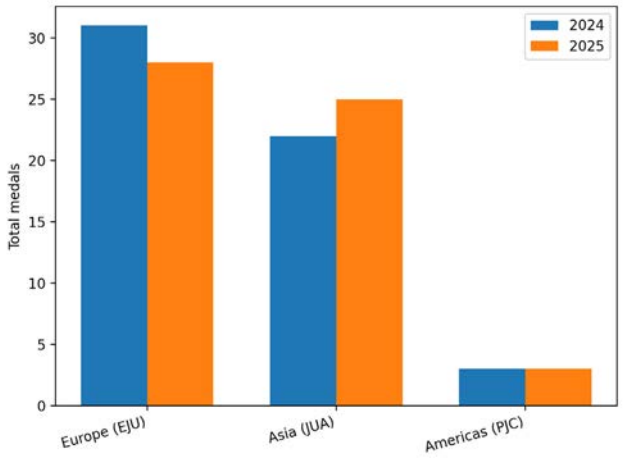


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Figure 2. Medal distribution by continent: 2024 vs 2025 comparison.

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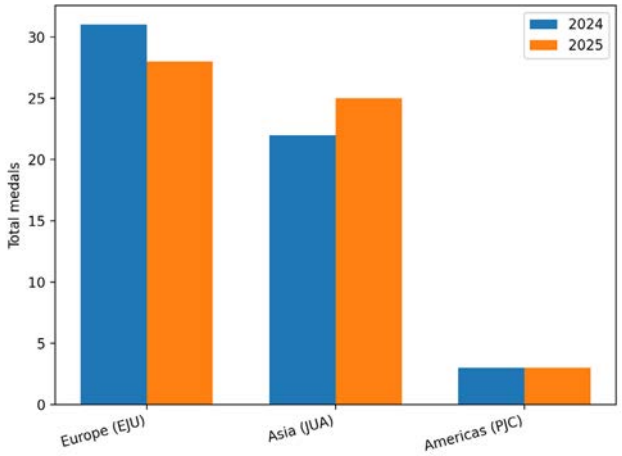

Source: European Judo Union (2025), EJU Report 2025.

Figure 2. Medal distribution by continent: 2024 vs 2025 comparison.

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The report highlights notable national contributors within Europe in 2025, including France (4 medals), Georgia (4), Azerbaijan (3), and Germany (3) (European Judo Union, 2025). It also notes an additional contextual factor: five men's medals were won by Russian athletes competing under the IJF flag, who are treated as EJU associates in

the report's classification (European Judo Union, 2025). This context is important when interpreting Europe's bloc-level strength and the distribution of medals within Europe.

Gendered medal patterns add nuance. In 2025, Europe achieved 15 women's medals (54%), decreasing from 18 (64%) in 2024 but still reflecting a strong women's performance profile (European Judo Union, 2025). Asia increased women's medals to 11 (39%) from 8 in 2024, while the Americas' women's medal contribution was 2 (7%) (European Judo Union, 2025). These shifts suggest that Europe's advantage remains relatively stronger in women's judo, while Asia's growth includes a strengthening women's contribution.

At the federation level, dispersion narrowed: medal-winning federations declined from 25 to 20 (2024-2025) (European Judo Union, 2025). A reduction in medal-winning federations suggests a tighter medal environment: fewer programmes convert participation into podium outcomes, even when total medals remain constant. This can coincide with generational change, strategic participation adjustments or the re-entry of high-performing athletes, but such mechanisms cannot be tested without athlete-level data.

Across 2021-2025, the report notes that Japan sustains dominance in gold medals (5, 5, 5, 3, 6), rebounding strongly in 2025 after a notable dip in 2024 (European Judo Union, 2025). In contrast, the EJU bloc demonstrates broad and collective strength with gold medals distributed across multiple nations over the five-year span. This contrast implies two different performance structures: a nation-centric dominance model (Japan) and a bloc-depth model (EJU).

For the Americas (PJC), the report describes a peak and decline pattern from 2023-2025, with 2025 characterised by low medal volume and limited signs of rising elite athletes (European Judo Union, 2025). While the 2024-2025 continental medal count for PJC is stable at three medals, the longer-run narrative suggests constraints and a ceiling effect. The performance implication is that maintaining a baseline medal presence does not necessarily indicate expanding competitive capacity.

An important interpretive conclusion is that post-Olympic contraction can coincide with an increased concentration of medal outcomes. Even if total participation falls, it does not produce wider medal dispersion automatically; instead, medals may consolidate among programmes that maintain depth, ranking access and transition capacity. This observation informs later recommendations on federation support and monitoring (EJU, 2025).

Age structure and uneven renewal

Age profiles provide a practical, if imperfect, lens on renewal, and prior time-motion work supports treating sex and weight category as meaningful analytical strata in elite judo (Soriano et al., 2019). In men's judo, the global average age of participants in 2025 remained in the range of 24.8-26.8 years, with a slightly higher global average than in 2024 (European Judo Union, 2025). The report notes slight decreases in average participant age compared with 2024 at -66 kg, -81 kg, -90 kg, and -100 kg, suggesting pockets of rejuvenation within an overall slight ageing trend (European Judo Union, 2025). The -60 kg category remains the youngest participant profile (24.83), while heavier categories (-100 kg and +100 kg) show higher participant ages (26.26-26.76), consistent with the report's interpretation that heavyweights may require greater technical and physical maturity (European Judo Union, 2025).

For women, the report describes an overall decrease in average participant age across most categories in 2025, relative to 2024. Participant ages range from 24.4 years (+78 kg) to 25.46 years (-63 kg) (European Judo Union, 2025). This pattern is interpreted as a post-Olympic rejuvenation, potentially reflecting retirements or reduced participation with resulting opportunities for younger competitors (European Judo Union, 2025). The report also notes category-specific variation within the EJU cohort, with some EJU categories for women younger than global averages (e.g., -48 kg, -57 kg, +78 kg) and others older (e.g., -78 kg: 26.19 vs 24.95 global) (European Judo Union, 2025).

Medallist age profiles in 2025 show that renewal is uneven and category specific. In men's weights, the report highlights younger medallists compared with 2024 in some categories, with the clearest examples being -81 kg (23.95 years) and -100 kg (24.78) (European Judo Union, 2025). At the same time, +100 kg medallists remain older (27.60) and -60 kg medallists also reflect the value of experience (26.13) (European Judo Union, 2025).

In women's categories, the pattern is mixed. Several categories display higher average ages on the podium, notably -70 kg (27.93) and -63 kg (27.82), indicating an advantage for experienced athletes at the top level (European Judo Union, 2025). Conversely, the +78 kg category shows a very young medallist age (22.87), interpreted as a clear sign of accelerated renewal in the heaviest women's category (European Judo Union, 2025). The report further notes that despite all four 2024 Olympic medallists competing at this world championships, older athletes suffered early eliminations at +78 kg, supporting the interpretation of a drastic generational shift in that category (European Judo Union, 2025).

These age-related findings suggest two programme-relevant points. First, renewal is not uniform across weight categories: some categories experience rapid turnover while others remain experience-dominated. Second, the relationship between participant rejuvenation and podium rejuvenation can diverge. Younger participation does not necessarily produce younger medallists; in some categories, the podium remains veteran-dominated even as the

field's average age decreases. These age-related indicators are interpreted together with mixed team participation below, because both capture renewal, depth and federation engagement.

WRL/seeding as a strong predictor with identifiable exception zones

Across 2025, seeding demonstrates high predictive power for medal outcomes. For men, seeded athletes captured 100% of medals at -66 kg, -81 kg, -100 kg and +100 kg, and 75% at -60 kg and -90 kg. The notable exception is -73 kg, where seeded-to-medal conversion drops to 50% (European Judo Union, 2025). For women, seeded athletes captured 100% of medals at -48 kg, -70 kg and +78 kg, and 75% at -52 kg, -57 kg and -78 kg. The exception is -63 kg at 50% (European Judo Union, 2025). Table 3 consolidates these conversion rates.

Table 3. Seeded-to-medal rates by weight category (men and women): summary + notable exceptions.

Division Category	Seeded to medal rate (2025)	Notable interpretation
Men -60 kg	75%	High predictability; seeded advantage
Men -66 kg	100%	Podium fully captured by seeded athletes
Men -73 kg	50%	Exception zone; greater upset space
Men -81 kg	100%	Podium fully captured by seeded athletes
Men -90 kg	75%	High predictability; seeded advantage
Men -100 kg	100%	Podium fully captured by seeded athletes
Men +100 kg	100%	Podium fully captured by seeded athletes
Women -48 kg	100%	Podium fully captured by seeded athletes
Women -52 kg	75%	High predictability; seeded advantage
Women -57 kg	75%	High predictability; seeded advantage
Women -63 kg	50%	Exception zone; greater room for upsets
Women -70 kg	100%	Podium fully captured by seeded athletes
Women -78 kg	75%	High predictability; seeded advantage
Women +78 kg	100%	Podium fully captured by seeded athletes

Source: European Judo Union (2025), EJU Report 2025.

This pattern indicates that WRL position is not merely descriptive; it is practically associated with podium probability. This interpretation is consistent with recent forecasting research showing the value of IJF WRL information for predicting Olympic medal outcomes (Guilheiro & Franchini, 2024). When seeded athletes capture most medals, competitive outcomes become structured: lower-ranked athletes face steeper pathways, often meeting seeded opponents earlier. From a programme perspective, this reinforces the importance of WRL-informed season planning, where ranking accumulation is integrated into athlete development and selection strategies (International Judo Federation, 2025).

The existence of exception zones is equally informative. The men's -73 kg and women's -63 kg categories provide more 'upset space', where unseeded athletes win a substantial share of the medals (European Judo Union, 2025). The report links the -73 kg exception to younger medallists compared with 2024, suggesting that renewal dynamics may increase volatility in specific categories (European Judo Union, 2025). For performance development, these categories can be treated as opportunity windows for emerging athletes and smaller federations.

At the same time, the broader pattern suggests that post-Olympic transition does not eliminate ranking predictability. Instead, it may create selective openings within an otherwise predictable environment. This has a practical implication for federation messaging and investment: post-Olympic years should not be framed as globally 'open,' but should be approached strategically, with targeted exploitation of category-specific volatility while maintaining the long-run need to accumulate ranking positions.

Any broader assessment of whether ranking systems produce equitable opportunity across federations would require additional federation-level data, including travel budgets, competition access and athlete support. Sport-policy research on elite systems indicates that financial resources, athlete support, training facilities and coach development are relevant drivers of international success, which supports treating ranking access as a programme and policy issue rather than a purely individual athlete issue (De Bosscher et al., 2009). In this manuscript, the descriptive pattern remains the central finding: seeding is strongly associated with medals, and the association is weight-category specific rather than uniform (European Judo Union, 2025).

Mixed team recovery as a federation engagement signal

The mixed team event provides an additional lens on federation engagement and organisational depth. In 2025, mixed team participation increased to 16 teams (national federations) and 172 athletes, compared with 13 teams and 136 athletes in 2024, though it remained below the 2023 peak of 18 teams (European Judo Union, 2025). The report interprets this as a positive recovery trend after the previous year's decline (European Judo Union, 2025).

EJU participation strengthened in 2025, with eight teams (seven in 2024, below nine in 2023) and an increase in EJU athletes to 85 (from 71 in 2024) (European Judo

Union, 2025). Fielding a mixed team requires depth across categories and both sexes, co-ordination of selection, and the capacity to sustain participation in an additional event. Mixed team engagement can therefore be treated as a proxy signal of federation depth and readiness to mobilise athletes beyond the individual competition structure.

Table 4. Age and renewal indicators: participants vs medallists (selected categories) + Mixed Team participation (2023-2025) as a compact sub-panel.

Panel A: Selected age indicators (years) reported for 2025

Sex	Category	Average age of participants (2025)	Average age of medallists (2025)	Interpretive signal (report-based)
Men	Global range	24.8-26.8	n/a	Slight increase vs 2024 overall; mid-20s profile
Men	-60 kg	24.83	26.13	Youngest participant profile; experience still matters on podium
Men	-81 kg	25.66	23.95	Younger medalist pocket; renewal signal
Men	-100 kg	26.26-26.76 (heavy categories)	24.78	Exception: younger medallists than participants
Men	+100 kg	26.26-26.76 (heavy categories)	27.60	Heavier category remains experience-weighted
Women	Participant range	24.4 (+78) to 25.46 (-63)	n/a	Overall participant rejuvenation vs 2024
Women	-63 kg	25.46	27.82	Older medallists; experience advantage at top level
Women	-70 kg	24.92	27.93	Older medallists; experience advantage at top level
Women	+78 kg	24.4	22.87	Accelerated renewal; very young podium profile
Women	EJU -78 kg (EJU vs global)	26.19 (EJU) vs 24.95 (global)	n/a	EJU older profile; possible experience strategy

Panel B: Mixed Team participation indicators

Year	Participating NFs/ Teams	Athletes (all)	EJU teams	EJU athletes
2023	18	166	9	79
2024	13	136	7	71
2025	16	172	8	85

Source: European Judo Union (2025), EJU Report 2025; Mixed team totals cross-checked with International Judo Federation (n.d.-c).

From a post-Olympic perspective, mixed team recovery suggests that federations may use the format to maintain competitive exposure, sustain team identity, and transition athletes into a new cycle. For continental unions, mixed team formats can act as engagement levers: incentives and support linked to mixed team participation may help retain federation involvement during the post-Olympic reset. Table 4 includes mixed team participation indicators as a compact sub-panel to support integrated monitoring.

DISCUSSION

The results support an integrated interpretation of the post-Olympic year as a re-scaling of the competitive field rather than a simple disruption. Participation falls substantially in 2025, yet several structural relationships persist: gender balance remains stable, EJU athlete share remains stable and seeding remains a strong predictor of medals (European Judo Union, 2025). This macro-level pattern complements contest-level judo research showing that scores, penalties, temporal units and technical efficiency remain decisive analytical dimensions in elite contests (Dopico-Calvo et al., 2023; Kons et al., 2018). The system's rules of competition remain in force even when the field contracts; what changes is the breadth of engagement and the distribution of opportunities across federations.

Three narratives integrate the evidence. The first is 'stable core, volatile periphery'. Bloc-level presence (EJU athlete share) remains steady, but federation breadth (participating nations; percentage of EJU nations) becomes more volatile in the post-Olympic year. A programme implication is that support should be targeted at the periphery (smaller or emerging federations) rather than at already-stable core programmes. Without such support, stable bloc shares may increasingly reflect concentration in fewer nations, which can undermine long-term depth and diversity.

The second narrative is 'predictable podia with selective openings'. The seeded-to-medal conversion rates are exceptionally high in many categories, indicating that WRL position strongly structures podium access. Yet two categories (men -73 kg; women -63 kg) stand out as exceptions where medals are not captured predominantly by seeded athletes (European Judo Union, 2025). These openings are not random noise; they are systematic in the sense that they recur as category-specific deviations from the general pattern. Federations can exploit such openings by aligning competition scheduling, tactical preparation and athlete selection to the categories where volatility is higher.

The third narrative is 'renewal pockets and weight-category specificity'. Age patterns show both rejuvenation and continued veteran dominance depending on category. For men, the overall slight ageing of participants combined with younger medallist pockets suggests a nuanced transition: the field may include more experienced athletes after the Olympics but some podium opportunities are seized by younger athletes in specific categories (Euro-

pean Judo Union, 2025). For women, participant rejuvenation is more general, yet podium ages remain older in some categories and dramatically younger at +78 kg (European Judo Union, 2025). This implies that transition programmes should be category-specific, not generic.

Continental competitive balance also benefits from a dual reading. Europe remains the leading continent in total medals in 2025 but declines slightly, relative to 2024, while Asia increases. The longer-run pattern indicates Japan's sustained gold dominance and the EJU's distributed gold success across multiple nations (European Judo Union, 2025). The policy implication for Europe is that bloc strength depends on sustaining multiple medal-capable programmes; threats to federation breadth (as seen in representation metrics) can therefore erode a core competitive advantage. For Asia, growth beyond Japan is visible in the report's narrative but the region remains Japan-centred in gold medal dominance (European Judo Union, 2025).

The Americas' low medal volume and the report's description of decline after a peak point towards potential constraints in building a broad base of elite athletes. Diagnosing those constraints would require additional data on investment, competition exposure and athlete pipeline dynamics. However, elite sport policy research indicates that inputs and throughputs such as finance, athlete support, facilities and coaching are relevant to international outcomes, providing a defensible framework for future comparative work (De Bosscher et al., 2009).

Mixed team recovery in 2025 adds a useful engagement signal. The increase in teams and athletes suggests that some federations re-engage quickly after the Olympic year. Because the mixed team event requires breadth and co-ordination, it can be used to maintain federation involvement strategically and build depth across categories. The EJU's strengthened presence supports the idea that the bloc maintains organisational capacity in the post-Olympic year (European Judo Union, 2025).

Limitations should be emphasised. This study is a secondary analysis of an organisational report; it does not provide athlete-level or contest-level evidence. The aggregated nature of indicators limits the ability to test mechanisms, assess confounders or model uncertainty. Classification choices (Russian athletes under the IJF flag treated as EJU associates; IRT classified as IJF) influence organisational shares and some medal interpretations (European Judo Union, 2025). Future work should complement aggregated reporting with athlete-level longitudinal datasets and contest-level indicators, following the type of notational and time-structured analyses used in recent judo performance research (Dopico-Calvo et al., 2023; Kajmovic et al., 2022; Soriano et al., 2019).

Taken together, the evidence points to a governance challenge: a post-Olympic contraction can leave the podium system highly predictable while reducing participation breadth. This makes the monitoring of smaller federations, category-specific renewal and WRL access particularly important. The dashboard proposed below therefore translates descriptive performance analytics into a practical review process for the next cycle (De Bosscher et al., 2009; European Judo Union, 2025).

IMPLICATIONS / RECOMMENDATIONS

Recommendation 1: Post-Olympic participation stabilisation support for smaller and emerging EJU NFs

The decline in participating nations from 107 (2024) to 93 (2025) and the fall in the percentage of EJU nations among participants relative to 2022 (Table 2) indicate that post-Olympic years can reduce federation breadth even when bloc-level athlete share remains stable (European Judo Union, 2025).

Action: establish a targeted stabilisation package for the first post-Olympic season aimed at smaller and emerging EJU federations. The package can combine travel support for priority events, shared regional training camps, and administrative assistance for planning and entry logistics. Eligibility should be linked to risk indicators (e.g., absence from post-Olympic world championships or a substantial reduction in senior entries) and should be framed as continuity support, not performance reward.

Recommendation 2: Category-specific transition programming based on renewal signals

Age and renewal signals are uneven across categories (Table 4). Some categories show accelerated renewal (women +78 kg medallists at 22.87 years), while others show sustained veteran advantage (women -70 kg and -63 kg medallist ages above 27 years; men +100 kg at 27.60) (European Judo Union, 2025).

Action: create a transition profile for each weight category, considering accelerated renewal, balance, experience-dominance. Then match programming to the profile: accelerated categories receive earlier international exposure, competition density and rapid integration support; experience-dominant categories receive mentoring structures, tactical preparation pathways and longer-term development plans to bridge the conversion gap from participation to podium.

Recommendation 3: Women's pathway reinforcement leveraging stable participation and medal strengths

The report indicates stable gender distribution and a rise in the proportion of women within the EJU cohort to 52% in 2025, alongside Europe's continued strength regrading women's medals (15 medals, 54%) (European Judo Union, 2025).

Action: prioritise continuity in women's programmes during the post-Olympic year rather than treating it as a 'down season.' Maintain competition opportunities, staf-

fing continuity and targeted support for categories where podium ages remain high (e.g., women -70 kg and -63 kg) to ensure succession planning without performance collapse. Recent tactical work on Olympic women's judo reinforces the value of category- and technique-sensitive preparation, including analysis of decisive ippon techniques (Ojeda-Aravena et al., 2025).

Recommendation 4: WRL/seeding-informed development planning, with upset-capacity targeted at open zones

Seeded athletes capture the majority of the medals across most categories (Table 3), confirming that WRL position remains a reliable predictor of podium success in the 2025 World Championships dataset (European Judo Union, 2025). This is consistent with the IJF's formal use of WRL structures in competition organisation and with research linking WRL-based information to medal forecasting (Guilheiro & Franchini, 2024; International Judo Federation, 2025).

Action: integrate WRL accumulation explicitly into annual performance plans through event selection, periodisation and budgeting. In parallel, design 'upset-capacity' interventions targeted at open zones (men -73 kg; women -63 kg), where seeded-to-medal conversion drops to 50%. These interventions can include tactical variability, opponent scouting and competition exposure designed to exploit higher volatility.

Recommendation 5: Mixed team events as an engagement lever and depth-builder

Mixed team participation recovered in 2025 (16 teams; 172 athletes), with strengthened EJU presence (8 teams; 85 athletes) (European Judo Union, 2025). Because mixed team events demand breadth and co-ordination, they can be treated as an engagement and depth indicator (Table 4).

Action: introduce incentives linked to mixed team participation (e.g., access to targeted camps, recognition mechanisms or support packages). Encourage federations to treat mixed team preparation as a structured pathway to build senior depth across categories, maintain motivation and retain federation engagement during the post-Olympic reset.

Recommendation 6: A minimal annual monitoring dashboard using six indicators

To institutionalise learning across cycles, monitoring should focus on a stable and minimal set of indicators that are already present in the reporting structure (European Judo Union, 2025). This aligns with elite sport policy research that distinguishes between input, throughput and output when evaluating international performance systems (De Bosscher et al., 2009).

Action: adopt an annual dashboard covering: (i) total participation and gender split (Table 1; Figure 1); (ii) EJU athlete share (Table 2); (iii) participating nations and percentage of EJU nations (Table 2); (iv) medal distribution by continent and number of medal-winning federations (Figure 2); (v) seeded-to-medal rates by category with flagged exceptions (Table 3); and (vi) renewal indicators (selected age profiles) plus mixed team participation (Table 4). Use the dashboard as an annual programme review trigger rather than an end-of-cycle retrospective.

CONCLUSION

The 2025 World Senior Championships show a clear post-Olympic contraction signature, with total participation falling to 556 athletes after higher stable 2023-2024 totals, while gender distribution remains broadly stable and women's representation within the EJU cohort strengthens (European Judo Union, 2025).

The EJU athlete share holds steady at 50-52%, yet federation breadth appears more volatile: participating nations decline from 107 to 93 and the proportional representation of EJU nations remains below its 2022 level (European Judo Union, 2025).

Competitive balance shifts modestly towards Asia in 2025, alongside a reduction in medal dispersion (25 to 20 medal-winning federations), indicating a tighter podium environment.

Seeding remains a strong predictor of medals across most categories, but identifiable exception zones (men -73 kg; women -63 kg) reveal selective openings that can be targeted strategically (European Judo Union, 2025).

Renewal signals are uneven and weight-category specific, combining young medallist pockets with persistent experience-dominant categories (European Judo Union, 2025).

Taken together, these patterns indicate that post-Olympic years should be treated as critical rebuild seasons requiring stabilisation support for smaller federations, category-specific transition programming, and explicit WRL-informed planning.

Future research would benefit from athlete-level longitudinal datasets, standardised multi-year dashboards and contest-level performance variables to test mechanisms and refine evidence-based policy (Dopico-Calvo et al., 2023; Kajmovic et al., 2022; Soriano et al., 2019).

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The Secrets of *Kosen* Judo: A 27-Year Historical Review of Competition

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Abstract: *Kosen is an amalgamation of Japanese words. 'Ko' is shortened from 'koto-gakko' (high school, HS) and 'sen' is an abbreviation of 'senmon-gakko' (vocational school, VS). Kosen judo has been recognized as a unique form of judo, specialising in ne-waza. However, several pieces of incorrect information and misunderstandings about kosen judo have been reported. This study focuses on the history and competition results of interschool judo competitions and the Kosen Judo Tournament (KJT) from 1914 to 1940. Detailed information about those competitions was collected mainly from the 3 books published by Okano and Yumoto. Decisive techniques of ippon (DTI) were investigated. Further, the DTIs were divided into nage-waza, katame-waza, awase-waza, and kiken-gachi, respectively. As the KJT is a team competition with consecutive matches by 15 students aged from 18 to 20 years, ne-waza was used mainly to train physically weak beginners, developing them into reliable judoka against advancing strong fighters during their 3-year stay in HS or VS.*

The government HSs won the championships from the 1st to the 20th KJT and private schools from the 22nd to the final 27th KJT. The rate of katame-waza in DTI was 31.0 % at the 1st KJT in 1914. However, it increased gradually from 52.3% in 1916 to 91.8 % in 1930. These figures show evidence that ne-waza techniques were developed in the KJT. It was realized that ne-waza was essential for the victory of the team competition with consecutive matches.

Keywords: *Kosen judo, ne-waza, Katame-waza, Kodokan judo, interschool judo competition*

Kosen is an amalgamation of Japanese words. '*Ko*' is an abbreviation of '*koto-gakko*' (high school, HS) and '*sen*' is an abbreviation of '*senmon-gakko*' (vocational school, VS). Therefore, the first *Kosen Judo* Tournament (KJT) was described as a "Japan high school and vocational school judo tournament" (Yumoto, 1967).

Interschool judo competition began around the end of the 19th century among high schools in some districts of Japan. The first KJT was organised by Kyoto Imperial University (KIU) in 1914 at the Kyoto Butokuden (martial arts practice hall) (Okano, 1954). Then the Four Imperial University Judo Association (4IUJA) succeeded in organising the KJT in 1926.As they had their own refereeing rules that differed from Kodokan judo refereeing rules, new fighting strategies with full use of *ne-waza* were developed by HS, VS, university preparatory course (UPC) students and their teachers to win the team competition with consecutive matches by 15 students.

Although *kosen judo* was recognised as a unique form of judo specialised in ne-waza, before World War II (WW II) the details of *kosen judo* had not been reported correctly. Much incorrect information and misunderstanding about *kosen judo* was shown not only in Japanese journals (Masuda, 2009; Masuda, 2012) but also in internationally recognised books and sports websites (Cunningham, 2002; International Freestyle Judo Alliance, Musa Betsu Kyu Judo club, 2015).

This study adopts a narrative review approach to investigate the background behind launching interschool judo competitions and the KJT. The old Japanese education system was also studied to clarify the characteristics of judo club students participating in the KJT. In addition, detailed match records of the annual KJT were investigated precisely, to correct misinformation about *kosen judo*, while introducing legendary contests, players and an outstanding contribution to the real progress of *ne-waza* during 27 years of the KJT.

MATERIALS AND METHOD

As the first step of this study, the old Japanese education system and the characteristics of judo club students were investigated to elucidate the background of the interschool judo competition and the KJT. As the next step, refereeing rules of student judo competition and the results of the interschool judo competition and the KJT were reviewed precisely through the 3 books published by Yo-

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shitaro Okano and Shuji Yumoto. Okano was the master of judo at the 6th HS, 8th HS and Nagoya Higher Commercial School (HCS), which participated in the KJT. Later he became the master of the Nagoya University judo club to teach *kosen judo* to the university students. The author, YN, learnt *kosen judo* himself, hearing about real teaching methods for the HS and VS students and the results of famous matches in the KJT, from Master Okano at the Nagoya University *dojo* from 1963 until his death in 1967. His professional guidance about the spirituality of *kosen judo* has been passed down for generations (Okano, 1954) (Figure 1-A). Yumoto, who was a Matsumoto HS student that participated in the KJT, later became a journalist and collected the results of most interschool judo competitions enthusiastically, detailing match records throughout the 27 years of the KJT from the newsletters published by more than 35 participating schools. Those schools reported detailed match records of the KJT, including wins, losses, draws and DTIs, in their annually published newsletters. He kept in close touch with graduates of participating schools to confirm the competition records were accurate and to receive missing data from 20 of those schools to increase the accuracy of survey results further. Finally, he published 2 books based on extensive research data: Tokon (fighting spirits) and Tokon, part 2 (Yumoto, 1967; Yumoto, 1972) (Figure 1-B, 1-C).

The dataset of the KJT was reviewed focusing on the trend of the decisive techniques of *Ippon* (DTI), while correcting the wrong pieces of information. Accurately recorded match results were retrieved from their books. First, the number of participating schools was counted by each type of school: HS, VS and UPC. Next, the available number of games with wins, losses and draws were counted while inaccurate games data was deleted. Also, DTI in every win and loss was recorded. However, DTI could not be clearly recognised in the small number of cases which were categorized as unknown. DTIs were divided into *nage-waza, katame-waza, awase-waza*, and *kiken-gachi*, respectively. The frequency of each DTI was calculated as its occurrence rate within all DTIs. The “unknown” was put in the same group of *kiken-gachi* to increase the accuracy of the frequency of each DTI.

Figure 1. The books of *KOSEN JUDO*
(A) The tradition of student judo – Around the *Kosen Judo* tournament by Y. Okano.
(B) Fighting spirit – Review of *Kosen Judo* by S. Yumoto.
(C) Fighting spirit Part 2 – Review of *Kosen Judo* by S. Yumoto.

RESULTS

The Old Japanese Education System

The old Japanese education system, before WW II, consisted of an elementary school for 6 years from age 6, then a middle school for 5 years, an HS for 3 years, VS for 3-4 years or UPC for 3 years, and finally a university or college for 3-4 years.

A government HS, the so-called ‘Number School’ was established in each of the 8 prefectural capitals since 1886. The 1st HS was established in Tokyo and the 3rd HS in Kyoto in 1886, which was followed by the 2nd HS in Sendai, the 4th HS in Kanazawa, the 5th HS in Kumamoto in 1887, the 6th HS in Okayama in 1900, the 7th HS in Kagoshima in 1901 and finally the 8th HS in Nagoya in 1908. In addition, 17 government HS’s, the so-called ‘named schools’ and 3 prefectural public HS’s were established in the prefectural capitals nationwide. Also, many government and private VS’s were built all over Japan. Furthermore, UPC was established in the imperial, public and private universities (Figure 2). Therefore, the age of HS, VS and UPC students was from 18 to 20 years old (Amano, 2015).

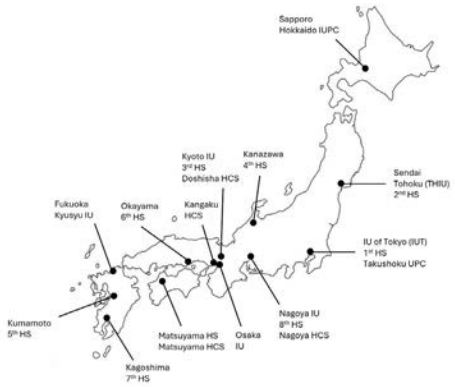

Figure 2. Placement of high schools, vocational schools, Imperial universities and university preparatory courses in Japan.

HS: High school, HCS: Higher commercial school, IU: Imperial university, UPC: University preparatory course

Rules of *Kosen Judo* Tournaments

The original refereeing rules of Dainihon Butokukai (Japan Martial Arts Association) jujutsu were established in 1899 and those of the Kodokan in 1900; those of the Kodokan being used in the KJT. However, the KJT rules were different from the modern rules of the Kodokan and International Judo Federation (IJF) rules. There was not an individual contest but a team competition with consecutive contests for 15 players. A player is eliminated after losing or drawing each contest and the winner of each contest remains on the *tatami* to compete with the next player until either losing or drawing a contest. The victor

Table 1. Interschool judo competition between the first and the second high schools

Date	Competition Venue	Number of players	Match time	Winner Wins / Losses / *Draws*	Decisive technique of Ippon		
					Nage-waza	*Katame-waza*	*Awase-waza*
15 Apr 1898	1st HS	17	20 min	2nd HS 12 / 10 / 5	22	0	0
11 Apr 1899	2nd HS	19	20 min Overtime 3+1 min	1st HS 13* / 11 / 7	21	2	0
6 Apr 1910	Tokyo Higher Normal School	18	NA	2nd HS 9* /6 / 9	10	3	1
7 Jan 1914	2nd HS	20	20 min Final 40 min	2nd HS 8 / 7 / 11	12	3	0
7 Apr 1918	2nd HS	18	15 min Semifinal 20 min Final 30 min	2nd HS 4 / 0 / 14	1	3	0

*: 1 *Itamigachi* is included. HS: High School

is the team left with one or more players when the last opposing player loses or draws. If the last contest ended in a draw, both players competed in extra time (*encho-sen*) with no time limit, until the 8th KJT. The KJT refereeing rules permit pulling the opponent directly into groundwork (ne-waza) using pull-down techniques. The score of techniques was limited to *ippon* and *waza-ari* only, and the contest was defined by ippon only, with no decision (*yusei-gachi*) allowed.

The Characteristics of Judo Club Students Participating in the KJT

Most of the government high school students who joined the judo club had no experience with judo and only a small number of students received a black belt while they were middle school students.

The KJT is a team competition with 15 players per team consisting of both strong black belt fighters and less experienced white belt students. Therefore, it became a basic strategy for a team victory to block an advancing strong fighter. *Ne-waza* takes less time to learn than the techniques of *nage-waza*. Therefore, a successful strategy was to train physically weak beginners in *ne-waza* and train them to be reliable defenders against strong black belt fighters within a short period during their stay in HS, VS or UPC. This is why HS students used *ne-waza* aggressively in the KJT and the majority of DTI resulted from *katame-waza*. Their hard training fostered an awareness of fighting spirit for the victory of the team, and honour of their alma mater which enhanced their friendships with their teammates (Okano, 1954).

Interschool Judo Competition

The interschool judo competition was held for the first time between the 1st and 2nd HSs on 15th April 1898. They established the rules of consecutive contests by 17 players and 15 minutes of match time with *encho-sen* of 3 minutes followed by 1 minute. The 2nd HS defeated the 1st HS. All 22 DTIs were *nage-waza* without *katame-waza*.

At the second competition with consecutive contests for 19 players, the 1st HS took revenge against the 2nd HS. The 2nd HS defeated the 1st HS at the 3rd and 4th competitions. The 5th competition was held with consecutive contests by 18 players in 1918. As there were 20 black belt students in the 1st HS and only 3 in the 2nd HS, the latter invited a *ne-waza* specialist, Tsunetane Oda, 4th dan, to hold a training camp for 3 months before the competition. The 2nd HS used *ne-waza* aggressively to avoid losing each contest and beat the 1st HS with 4 wins, 0 losses and 14 draws (*hikiwake*). *Nage-waza* was used only in 1 match, while *katame-waza* were used in the remaining 3 matches. All 4 winners of the 2nd HS were white belt students and 3 of the 4 losers of the 1st HS beaten by *katame-waza* were black belt students (Table 1).

In western Japan, an interschool judo competition was also held between the 3rd HS and the allied forces of the 4th HS and Kanazawa Vocational Medical School on 12th May 1901, at the Kyoto Butokuden. They established the rules of consecutive contests of 20 players with a contest time of 10 minutes. The 3rd HS won the game with 15 wins, 12 losses and 5 draws. All 27 DTIs consisted of 21 *nage-waza* and 6 *katame-waza*, respectively. The 3rd HS invited the 4th and the 6th HS to the next interschool judo competition with consecutive contests for 17 players in 1907. Subsequently, the 6th HS organised the interschool judo competition against the Osaka Higher Medical School in 1907 and the Kobe Higher Commercial School in 1908. The 5th HS defeated the 7th HS at the 7th HS *dojo* in 1910.

The Kyoto Imperial University Judo Club suggested star-

Table 2. Interschool judo competitions in western Japan

Date	Venue	Game	No. of Players / Time	Winner	Match Results (W/L/D)	Decisive technique of Ippon		
						Nage-waza	*Katame-waza*	*Unknown*
5 Dec 1901	Kyoto Butokuden,	3rd HS vs 4th HS + KVMS	20 players / 7–12 min	3rd HS	15 / 12 / 5	21	6	NA
4 Feb 1907	3rd HS	3rd HS vs 4th HS	17 players / NA	4th HS	10 / 7 / 7	11	2	4
4 Mar 1907	3rd HS	4th HS vs 6th HS	NA / 30 min	4th HS	NA	NA	NA	NA
4 Apr 1907	3rd HS	3rd HS vs 6th HS	NA	Draw	NA	NA	NA	NA
5 Dec 1907	6th HS	6th HS vs Osaka HNS	15 players / NA	6th HS	10 / 9 / 5	NA	NA	NA
29 Nov 1908	Kobe HCS	6th HS vs Kobe HCS	15 players / 20 min	6th HS	10 / 9 / 5	NA	NA	NA
18 Apr 1909	6th HS	3rd HS vs 6th HS	NA	3rd HS	NA	NA	NA	NA
31 Oct 1909	6th HS	6th HS vs Kobe HCS	17 players / NA	6th HS	12 / 11 / 5	NA	NA	NA
3 Jan 1910	7th HS	5th HS vs 7th HS	15 players / NA	5th HS	10 / 9 / 5	NA	NA	NA
6 Jan 1912	3rd HS	3rd HS vs 6th HS	15 players / 20 min	6th HS	8 / 6 / 8	2	NA	12
7 Jan 1912	3rd HS	5th HS vs 6th HS	15 players / NA	Draw	7 / 7 / 8	3	6	5
8 Jan 1912	3rd HS	3rd HS vs 5th HS	15 players / 20 min	5th HS	5 / 4 / 10	4	4	1
6 Jan 1914	6th HS	3rd HS vs 6th HS	15 players / 20 min	3rd HS	5 / 3 / 11	NA	NA	NA

W: Wins, L: Losses, D: Draws, HS: High School, KVMS: Kanazawa Vocational Medical School, HNS: Higher Normal School, HCS: Higher Commercial School, NA: Not available

ting the regularly scheduled interschool judo competition among the 3rd HS, 5th HS and 6th HS and they started the competition in 1912 with the established rules of consecutive contests of 15 players and a contest time of 20 minutes. Due to the efforts of the graduate members of the 3rd and 6th HSs, the interschool competition between the 2 HSs was held on 6th January 1914; the 3rd HS defeated the 6th HS by 5 wins, 3 losses and 11 draws (Table 2).

Annual Records of *Kosen Judo* Tournaments

A cumulative total of 662 schools participated in the KJT during the 27-year period from 1914 to 1940 and a total of 365 games were retrieved from the data. Finally, a total of 2,123 wins, 906 losses and 3,302 draws were confirmed, while also counting a total of 134 unknown (or *kiken-gachi*) throughout the 27 iterations of the KJT.

Dawn of the *Kosen Judo* Tournament (KJT)

The graduate members of the 3rd, 4th, 5th and 6th HSs who had been enrolled in the KIU planned the interschool judo tournament among the government HSs and VSs. Finally, Professor Torasaburo Araki, the president of KIU, organised the first KJT from 29th to 31st December 1914 at the Kyoto Butokuden (Okano, 1954). Only 3 HSs (4th HS, 6th HS and 7th HS) participated in the first KJT. The 4th HS defeated the 7th HS by 2 wins, 1 loss and 13 *hikiwake*, and won the first KJT championships.

Six schools participated in the second KJT in 1915. In the final game, the 4th HS defeated the 6th HS by 6 wins, 5 losses, and 9 *hikiwake*. The 6 DTIs by the 4th HS consisted of 3 *nage-waza*, 2 *shime-waza*, and 1 *awase-waza*. On the other hand, the 6th HS students had received hard training in *ne-waza* from the master Yoshitaro Okano. They used *ne-waza* aggressively and the 5 DTIs consisted of 3 *osaekomi-waza* and 2 *shime-waza*. It was remarkable that Kawachi from the 6th HS won the 3 contests by *osaekomi-waza* consecutively and Komai from the 4th HS won 2 contests by *shime-waza*. Then the 4th HS won 2 consecutive championships at the KJT. Ohtsu, the captain of the 4th HS judo team, reported his impression of the KJT in Shijukai Newsletter, the annual journal of the graduate association of the 4th HS judo club, as follows: “the participants took many lessons from the KJT and fully realised that KJT is a kind of teamwork, and that *ne-waza* is essential for the victory of the KJT, a team competition with consecutive matches for 15 players” (Yumoto, 1967).

The hard-fought rivalry between the 4th HS and 6th HS was also shown in the final game at the 3rd KJT and resulted in a three-all *hikiwake*. It was remarkable that all 6 DTIs were *katame-waza*, with 3 *shime-waza* by the 4th HS and 2 *osaekomi-waza* and a *shime-waza* by the 6th, respectively. Finally, both 4th HS and 6th HS won the 3rd KJT championships with 1 win and 1 *hikiwake*. Looking back at the 3rd KJT, *katame-waza* was used aggressively and accounted for more than 57% of the DTIs.

The 4th HS continued to win a very close game annually against the 6th HS with 1 win, 0 losses and 14 *hikiwake*, respectively, until the 6th KJT. DTIs at the 5th and the 6th KJT were all *katame-waza* (*osaekomi-waza*).

The educational system of Japanese high schools changed in 1920; the beginning of the new semester was changed from September to April. Then the 7th KJT was held from 25th to 28th August 1920, and the 4th HS won the final game against the 6th HS, also with 1 win by *harai-goshi*, 0 losses, and 14 *hikiwake*, the same as the previous 3 years and won 7 consecutive championships in the KJT. Based on the available records of DTI, *katame-waza* was used more aggressively than in the previous year, used in 15 (88.2 %) of 17 DTIs in 5 games. *Hikiwake* also increased.

In the semi-final game of the 8th KJT between the 4th and 6th HSs, fierce fighting with a *hikiwake* continued until the final match. However, it still in an *encho-sen* for 20 minutes and ended with an all-*hikiwake* scoreline (0-0). The 4th and 6th HS teams could not advance to the final championship game and the championship flag was awarded to the 5th HS, so the 4th HS's winning streak ended at 7. Based on available records of DTI in 5 games, *katame-waza* was used in 18 (85.7 %) of 21 DTIs.

Development of the KJT

The 4th HS, having won 7 consecutive championships, lost the first game against the 5th HS in the 9th KJT in 1922, and the 6th HS defeated the 5th HS in the final game and captured the KJT champion flag. The 4th and 6th HSs have vied for the championships since the opening of the KJT in 1914, and the 6th HS achieved a solo victory of KJT for the first time and started the memorial 8 consecutive championships. Based on available records of DTIs in 3 games, *katame-waza* was used in 19 (82.6 %) of 23 DTIs.

The 6th HS defeated the 4th HS with 6 wins, 0 losses and 9 *hikiwake* in the semi-final game of the 10th KJT. Masaru Hayakawa, a second-year student of the 6th HS, won the match with *ude-hishigi-sankaku-gatame* (triangle lock) which was the first trial in the history of the KJT. The 6th HS won the final game against the 5th HS with 7 wins, 0 losses and 8 *hikiwake* and achieved 2 consecutive championships in the KJT. This is the first year that Masaru Hayakawa from the 6th HS performed a form of *kansetsu-waza* named *matsuba-garami* (pine needle lock) which was later renamed *sankaku-garami* or *sankaku-gatame* (triangle lock).

The 6th HS finally defeated the 4th HS and established 3 consecutive championships in the 11th KJT. Based on the available records of DTIs achieved in the 3 games, 25 DTIs consisted of 4 *nage-waza* (16 %), 20 *katame-waza* (80 %) and 1 unknown (4 %), respectively.

Table 3. Changes of Decisive Techniques of Ippon (DTI) from No.1 to No.11

No.	Year	Participants	Games*	Results of Matches*			DTI*				National Champion
				Wins	Losses	*Draws*	*Nage-waza*	*Katame-waza*	*Awase-waza*	Unknown /*Kiken-gachi*	
1	1914	3	3	16	13	29	10	9	2	8	4th HS
2	1915	6	4	29	19	31	17	16	1	14	4th HS
3	1916	4	4	24	18	36	16	22		4	4th HS
4	1917	4	1	1	6	14	NA	NA	NA	NA	4th HS
5	1918	4	4	15	3	45	6	8	0	4	4th HS
6	1919	7	4	14	2	46	4	10	0	2	4th HS
7	1920	6	5	15	4	60	2	15	1	1	4th HS
8	1921	9	8	21	0	54	3	18	0	0	5th HS
9	1922	8	3	17	6	18	3	19	1	0	6th HS
10	1923	13	9	61	9	73	12	48	0	10	6th HS
11	1924	11	3	18	7	26	4	20	0	1	6th HS

*: available number, HS: High School

The Birth of the Regional Rounds of the KJT

In 1925, the Imperial University of Tokyo (IUT) and KIU established the Imperial University Judo Association (IUJA) and organised the eastern and central rounds followed by a national round of the KJT. The IUT organised the first eastern round of the 12th KJT and Hokkaido Imperial University Preparatory Course (HIUPC) won the eastern round championships.

The 6th HS defeated the Matsuyama HS in the final game of the first central round of the 12th KJT organised by KIU, won the national championships against HIUPC and established 4 consecutive national championships. Based on available records of DTIs achieved in the 8 games, 61 of those DTIs consisted of 10 *nage-waza* (16.4 %), 50 *katame-waza* (82.0 %) and 1 unknown, respectively.

In 1926, Kyushu Imperial University (KSIU) and Tohoku Imperial University (THIU) joined the IUJA and the Four Imperial University Judo Association (4IUJA) was established and organised 3 regional rounds: the eastern round by IUT and THIU, the central round by KIU, and the western round by KSIU. They were followed by the national round in Kyoto. HIUPC won the final game of the eastern round of the 13th KJT. The final game of the western round was drawn (*hikiwake*) and Yamaguchi HCS was selected as the western round champion by lottery. Matsuyama HS defeated the 8th HS in the semi-final game of the central round, and the 6th HS won the final game against Matsuyama HS. The 6th HS defeated Yamaguchi HCS and HIUPC at the national round and established 5 consecutive national championships at the KJT.

HIUPC established 3 consecutive eastern round championships at the 14th KJT in 1927. Compared to the last year, the rate of *katame-waza* in DTIs increased from 41.7 % to 76.2 %. On Conversely, that of *nage-waza* decreased markedly from 58.3 % to 9.5 %, respectively. The 5th HS established 2 consecutive western round championships. The 6th HS defeated the Matsuyama HS in the final game of the central round, HIUPC in the final game of the national round and established 6 consecutive national championships at the 14th KJT. Based on the available records of DTIs achieved in 7 games of the central and national rounds, 59 DTIs consisted of 10 nage-waza (16.9 %), 47 *katame-waza* (79.7 %), and 2 unknowns (3.4 %), respectively.

In 1928, HIUPC defeated Yamagata HS and established 4 consecutive eastern round championships at the 15th KJT. KSIU organised the western round and invited some schools in a colony or overseas territory. 13 schools, including the Keijo Imperial University PC in Seoul, Manchurian Medical University PC in northeast China and Tung Wen College (TWC) in Shanghai, participated in the western round. Yamaguchi HS drew the final game and was selected by lottery to advance to the national round. The 6th HS, the central round champion, won the national round and established 7 consecutive national championships at the 15th KJT. Compared to the last year, the rate of *nage-waza* decreased markedly from 17.4 % to 8.0 %. On the contrary, that of *katame-waza* increased from 78.3 % to 92.9 %.

HIUPC established 5 consecutive eastern round championships at the 16th KJT. The 5th HS won the western round championships. The final game of the central round between the 6th HS and the Matsuyama HS became a tough battle. K. Nakagawa, captain of the 6th HS, defeated 2 players consecutively and fought with the captain of the Matsuyama HS for 60 minutes. The game ended in *hikiwake* 4 – 4 after 30 minutes of *encho-sen*, with both schools winning. The 6th HS was selected by lottery to advance to the national round and defeated HIUPC and the 5th HS. Then 6HS established 8 consecutive national championships at the 16th KJT. Based on available records of 10 games in the central round, 88 DTIs consisted of 6 *nage-waza* (6.8 %) and 82 *katame-waza* (93.2 %), respectively.

Born of New Champions in the KJT and Dying Days

HIUPC established 6 consecutive eastern round championships at the 17th KJT in 1930. Based on available records of 7 games, 52 DTIs consisted of 2 *nage-waza* (3.8 %), 50 *katame-waza* (96.2 %), respectively. This figure showed a further rising trend of *katame-waza* from 89.2 % to 96.2 % since the previous year. Yamaguchi HCS won the western round championships for the first time. Matsuyama HS won the central round championships and also defeated HIUPC to win the national championships for the first time. Based on available records of 7 games in the central round, 56 DTIs consisted of 5 *nage-waza* (8.9 %), 50 *katame-waza* (89.3 %) and 1 unknown (1.8 %), respectively. Furthermore, 147 DTIs consisted of 11 *nage-waza* (7.5 %), 135 *katame-waza* (91.8 %) and 1 unknown (0.7 %), respectively, in 19 games of the 17th KJT.

In 1931, the invincible HIUPC team lost a preliminary game against the 2nd HS which was strong in *ne-waza* and won the eastern round championships at the 18th KJT for the first time. Saga HS defeated Yamaguchi HS and won the western round championships for the first time. Matsuyama HS defeated Kangaku HCS in the final game of the central round and won 2 consecutive national championships at the KJT.

Hirosaki HS drew the final game of the eastern round and was selected by lottery to advance to the national round of the 19th KJT in 1932. The 5th HS won the final game against Meiji VS and regained the western round championships after 2 years. Matsuyama HS won the final game of the central round against the 6th HS, won the national round and established 3 consecutive national championships at the 19th KJT.

In 1933, HIUPC avenged the semi-final game at the eastern round against the 2nd HS and drew the final game against Hirosaki HS which was selected by lottery to advance to the national round of the 20th KJT. At the western

Table 4. Changes of Decisive Techniques of Ippon (DTI) from No.12 to No.23 KJT

No.	Year	Regional Round	Partici-pants	Games*	Results of Matches*			DTI*				National Champion
					Wins	Losses	*Draws*	*Nage-waza*	*Katame-waza*	*Awase-waza*	Unknown /*Kiken-gachi*	
12	1925	E	4	2	15	5	14	5	15	0	0	
		C	12	7	41	20	79	10	50	0	1	6th HS
		T	16	9	56	25	93	15	65	0	1	
13	1926	E	5	3	23	4	NA	14	10	0	3	
		W	9	4	23	8	37	7	22	1	1	6th HS
		C/N	11	5	39	9	35	5	41	1	1	
		T	25	12	85	21	72	26	73	2	5	
14	1927	E	7	2	18	3	12	2	16	0	3	
		W	10	5	24	10	51	7	27	0	0	6th HS
		C/N	11	7	47	12	58	10	47	0	2	
		T	28	14	89	25	121	19	90	0	5	
15	1928	E	6	7	49	19	54	2	65	0	1	
		W	13	7	36	19	69	11	44	0	0	6th HS
		C/N	14	18	116	35	154	12	139	0	0	
		T	33	32	201	73	277	25	248	0	1	
16	1929	E	8	5	22	15	53	4	33	0	0	
		W	10	10	50	17	100	5	49	1	12	6th HS
		C/N	14	12	79	22	100	9	92	0	0	
		T	32	27	151	54	253	18	174	1	12	
17	1930	E	7	7	37	15	68	2	50	0	0	
		W	12	5	26	13	49	4	35	0	0	Matsuyam a HS
		C/N	14	7	44	12	61	5	50	0	1	
		T	33	19	107	40	178	11	135	0	1	
18	1931	E	8	7	51	16	54	2	65	0	0	
		W	11	8	43	17	77	5	49	2	4	Matsuyam a HS
		C/N	15	17	106	32	149	13	124	1	0	
		T	34	32	200	65	280	20	238	3	4	
19	1932	E	9	5	28	13	47	2	38	0	1	
		W	12	6	32	11	58	2	39	1	1	Matsuyam a HS
		C/N	15	13	78	27	117	12	91	0	2	
		T	36	24	138	51	222	16	168	1	4	
20	1933	E	12	9	64	27	79	5	84	1	1	
		W	16	5	35	13	40	8	40	0	0	6th HS
		C/N	18	11	68	26	97	14	80	0	0	
		T	46	25	167	66	216	27	204	1	1	
21	1934	E	10	9	63	29	72	4	88	0	0	
		W	16	6	30	10	60	4	34	2	0	Hokkaido IUPC
		C/N	20	14	78	36	132	17	95	0	2	
		T	46	29	171	75	264	25	217	2	2	
22	1935	E	10	7	40	20	65	4	54	2	0	
		W	15	6	21	10	69	3	19	0	9	Kangaku HCS
		C/N	17	6	23	14	60	4	33	0	0	
		T	42	19	84	44	200	11	106	2	9	
23	1936	E	14	12	79	35	101	6	103	1	4	
		W	16	4	14	9	46	5	18	0	0	Takushoku UPC
		C/N	22	11	52	24	113	5	71	0	0	
		T	52	27	145	68	260	16	192	1	4	

E: Eastern, W: Western, C: Central, C/N: Central & National, T: Total, *: available number

round, Ohita HCS was selected to advance to the national round. The 6th HS won the central round championships and regained the national championships at the KJT after 4 years. Based on available records of 25 games, 233 DTIs consisted of 27 *nage-waza* (11.6 %), 204 *katame-waza* (87.6 %), 1 *awase-waza* and 1 unknown, respectively.

In 1934, HIUPC won the eastern round championships at the 21st KJT, for the first time in 4 years. Ohita HCS won the western round championship for the first time. Matsuyama HS won the central round championship for the fourth time. HIUPC won the semi-final and final games of the national round against Ohita HCS and Matsuyama HS, respectively, and established the first record of the national championships at the KJT as a non-government HS.

HIUPC defeated the 2nd HS and attained supremacy at the eastern round of the 22nd KJT in 1935.

Kangaku HCS defeated Doshisha HCS in the final game of the central round, beat Yamaguchi HCS, western round champion in the final game of the national round, and won the national championships at the KJT for the first time as a private HCS.

The Takushoku UPC (TUPC) team, trained by master Tatsukuma Ushijima, participated in the 23rd KJT for the first time and defeated the HIUPC, a defending champion, and won the eastern round championships in 1936. The TWC team, trained by master Haku Michigami, drew the final game of the western round against the 7th HS and was selected by lottery to advance to the national round of the KJT as the first overseas school.

In the central round, Nagoya HCS team, trained by the master Yoshitaro Okano, won the central round championships at the KJT for the first time as a government HCS. In the national round, TUPC defeated Nagoya HCS in the semi-final game. Masahiko Kimura, 5th dan and second-year student, was the team captain and beat the last 3 succeeding players of Nagoya HCS to win the game. TUPC also defeated TWC in the final game and won the national championships. Based on available records of 17 DTIs in the above 2 games, *katame-waza* was presented in 16 contests (94.1 %) and *nage-waza* in only 1 contest (5.9 %). TUPC established the national championships at the KJT for the first time while participating in the KJT for the first time. However, this victory was the first and last one for the TUPC (Table 4).

In 1937, the eastern round was divided into the northern and the eastern rounds, and HIUPC won the first northern round championships at the 24th KJT. TUPC won the final game of the eastern round. TWC drew the final game of the western round and was selected by lottery to advance to the national round. Doshisha HCS won the central round championships for the first time and competed with the last champion TUPC at the final game of the National round. Although the captain, Kimura, a 3rd year student of TUPC was the national judo champion of this year, he could not beat Doshisha HCS which won the national championships at the KJT for the first time.

Tohoku-Gakuin VS won the northern round championships for the first time in 1938. Kangaku HCS won the central round championships. Further, Kangaku HCS defeated Nagasaki HCS, western round champion and TUPC, eastern round champion in the semi-final and final games of the national round of the 25th KJT, respectively, and won the national championships at the KJT for the second time in 1938.

Tohoku-Gakuin VS established 2 consecutive northern round championships in 1939. TUPC won 4 consecutive eastern round championships. Based on the available records, *katame-waza* was presented in 24 (100 %) of 24 DTIs in 2 games. Fukuoka HCS won the western round championships for the first time. Kangaku HCS won 2 consecutive central round championships and also established 2 consecutive national championships at the 26th KJT.

The Sino-Japanese War became more serious and the socially tense situation continued to get worse. Therefore, the year 1940 became the last chance to organise the 27th KJT. HIUPC won the northern round championships for the second time. TUPC established 5 consecutive eastern round championships. Based on available records, *katame-waza* was presented in 15 (100 %) of 15 DTIs in 2 games just like the previous year. Kyushu MVS won the western round championships. Matsuyama and Doshisha HCSs drew the final game of the central round and Matsuyama HCS was selected by lottery to advance to the national round. Matsuyama HCS defeated TUPC and Kyushu MVS and won the national championships at the KJT for the first time (Table 5).

As the Pacific War loomed in 1941, the Japanese Education Ministry issued the indefinite postponement of the KJT and the KJT disappeared forever because of the outbreak of the Pacific War on 8th December 1941.

Legendary Matches Between the 4th HS and 6th High Schools

The 4th and the 6th HSs were contenders for the championships. At the final match of the 3rd KJT, Kawachi, captain of the 6th HS, showed legendary fierce fighting with the last 3 players of the 4th HS. After defeating the 2 opponents consecutively by *osaekomi-waza* and *shime-waza*, he continued to fight the final contest against Komai, the captain of the 4th HS, with unlimited time. As this closed match remained unsettled for 60 minutes, the organiser decided to send the contest into *encho-sen* for 40 minutes. However, the tense contest was still unsettled for 40 minutes and ended in a three-all (3-3) *hikiwake* after 7:00 PM. As a result, Kawachi fought for more than 2 hours. Finally, both 4th and 6th HSs won the 3rd KJT championships with 1 win and 1 *hikiwake*.

Table 5. Changes of Decisive Techniques of Ippon (DTI) from No.24 to No.27 KJT

No.	Year	Regional Round	Partici-pants	Games*	Results of Matches*			DTI*				National Champion
					Wins	Losses	*Draws*	*Nage-waza*	*Katame-waza*	*Awase-waza*	Unknown /*Kiken-gachi*	
24	1937	N	5	6	41	25	49	5	61	0	0	Doshisha HCS
		E	13	4	25	14	34	5	32	0	2	
		W	17	6	25	12	65	6	31	0	0	
		C/N	24	12	75	40	105	10	101	3	1	
		T	59	28	166	91	254	26	225	3	3	
25	1938	N	8	5	29	21	46	2	47	0	1	Kangaku HCS
		E	7	2	14	12	16	1	23	0	2	
		W	14	6	27	16	63	7	29	0	7	
		C/N	24	12	91	38	89	14	94	1	20	
		T	53	25	161	87	214	24	193	1	30	
26	1939	N	6	5	32	13	57	5	40	0	0	Kangaku HCS
		E	9	2	17	7	13	0	24	0	0	
		W	19	7	37	19	68	8	45	3	0	
		C	27	8	52	27	67	7	61	2	9	
		T	61	22	138	66	205	20	170	5	9	
27	1940	N	6	4	29	14	31	7	35	1	0	Matsuyama HCS
		E	8	2	12	3	18	0	15	0	0	
		W	19	8	34	22	86	3	50	0	3	
		C	25	10	65	34	84	15	82	0	2	
		T	58	24	140	73	219	25	182	1	5	

N: Northern, E: Eastern, W: Western, C: Central, C/N: Central & National, T: Total, *: available number

At the semi-final game of the 8th KJT on 26 July 1921, a serious problem occurred in the legendary game between the 4th and the 6th HSs. After continuing through 7 *hikiwake* contests, a 6th HS player applied a right knee joint lock, although leg-locking (*ashi-garami*) was prohibited by the KJT rules. The 4th HS team claimed a *kinshi-waza* (prohibited technique) of knee joint locking. However, the 6th HS team disputed the claim and argued that this knee joint lock is not *ashi-garami* but a newly developed knee joint lock named 'leg-bar' (*ashi-hishigi-juji-gatame*) which is not a prohibited locking technique (*kansetsu-waza*). After a long discussion about the newly developed *ashi-garami*, the two teams reached a consensus on the following, "Because of the insufficient rules of the KJT, the new *ashi-garami* was not forbidden but should not be used anymore."

The game resumed at 10 pm and fierce fighting with *hikiwake* continued until the final match started at midnight and remained unsettled for 60 minutes. The tournament doctor stopped the match after an intense 60-minute battle because both captains were utterly exhausted and took a rest for 20 minutes. Finally, the game was sent into *encho-sen* for 20 minutes. However, the fierce fighting remained unsettled for 20 minutes and ended in an all-*hikiwake* (0-0) around 1:30 am. The 4th and 6th HS teams could not advance to the final championship game and the champion flag was awarded to the 5th HS team. So, the 4th HS's winning streak ended at 7. After the hard-fought contest between the captains of the 4th and 6th HSs, the final match time was changed from unlimited time to 60 minutes.

Changes in DTI Ratio and Draw Match Rate Throughout the KJT

As shown above, *ne-waza* was used actively and new techniques were developed year after year. The rate of *katame-waza* in DTIs was around 30 % at the beginning of the KJT. As predicted by Ohtsu, the captain of the 4th HS, in 1914, *katame-waza* in DTIs increased to over 50 % at the 3rd KJT, as a result of the increasing number of close games like the hard-fought one between the 4th and 6th HSs. Thereafter it has continued to rise to over 80 % at the 8th KJT and around 90 % since the 15th KJT. On the other hand, *hikiwake* was around 50 % of the contests throughout the entire course except for the period from the 4th to the 8th KJT. It increased around 70 % because the fierce battle continued between the 4th and 6th HSs (Figure 3).

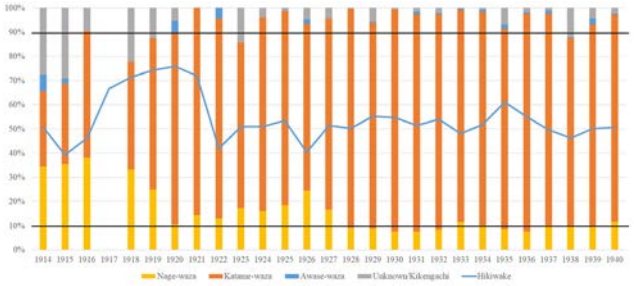

Figure 3. Changes in DTI ratio and draw match rate throughout the KJT

Four Phases of *Kosen Judo* Tournaments

The number of participating schools in the KJT, changes of DTIs, and a champion school in each year are shown in Table 4 and 5. The duration of KJT is divided into 4 phases according to the increasing number and types of participating schools, showing a traditional development of *Kosen Judo*. During the 1st phase, from the 1st to the 7th KJT, the number of participating schools was less than 5 and the 4th HS established 7 consecutive championships The 2nd phase, from the 8th to the 11th KJT, Imperial and public UPCs also participated in the KJT and the number of participants increased to over 10. During the 3rd phase, from the 12th to the 20th KJT, private VSs and private UPCs participated in the KJT and the number of participants increased to over 40. The government schools organised the middle school judo tournaments under the KJT rules which contributed to the development of *kosen judo* nationwide. However, after the Great Depression in 1932, the government HS students struggled against leftish movement which hampered the athletic activities in their HSs, while still training their skills, keeping the honour of tradition in mind to establish the championships for 20 years. Further, middle school students were required to maintain high academic achievement to pass the entrance examination for government high schools. On the other hand, private schools could recruit strong middle school students actively by recommendation. Under these circumstances, the maximum number of participants reached 60 during the 4th phase. The number of government HSs was always the biggest which was followed by those of government VSs, private VSs and UPCs. The government HSs won the national championships from the 1st to the 3rd phase for 20 years and UPC or private HCSs followed the championships during the 4th phase for 7 years, while government HSs have never won the championships again (Table 6).

DISCUSSION

HS judo clubs were established in the late 19th century (e.g., the 1st HS in 1890 and the 2nd HS in 1893) and they invited the master from the Kodokan (e.g., Sakujiro Yokoyama to the 1st HS in 1895 and Kunijiro Iizuka to the 2nd HS in 1897). The 4th HS also invited the master Sadao Egawa from the Kodokan to succeed master Mareo Fujiyoshi in 1913. Therefore, HS students learned *nage-waza* of Kodokan judo predominantly, in eastern Japan. Under such circumstances, *nage-waza* were predominantly used in the interschool judo competitions as shown above (Kudo, 1972). On the other hand, the 6th HS judo club was established in 1902 and invited Gyotaro Imai, master of Takenouchi-ryu jujutsu in Okayama who died in 1910 and was replaced by Yoshitaro Okano from Dainihon Butokukai in Kyoto. As a *ne-waza* specialist, Okano won the national championships 4 times. In 2 out of them, he beat Fujiyoshi in 1907 and Egawa in 1920, respectively (Okano, & Nimura, 2022). As described above, Okano taught *ne-waza* enthusiastically for the 6th HS students to win the KJT, and as a result, the rate of *katame-waza* in DTIs increased from the 3rd KJT in 1916. Okano emphasised the value of *ne-waza* to win the team competition and so their hard training in *ne-waza* to win the KJT enhanced friendships with their teammates and contributed to their personal development (Okano, 1954).

After the 5th interschool judo competition, between the 1st and 2nd HSs in 1918, Jigoro Kano, who established Kodokan judo, criticised the 2nd HS's fighting strategy of using *ne-waza* in a team competition which was inappropriate for the basic style of Kodokan Judo (Kano, 1918; Kano, 1918). Kano warned against focusing too much on *ne-waza* in student judo competitions. Because he had emphasised that judo helps not only the physical development of young students but also their mental growth, they grow as individuals through having various experiences with *nage-waza* followed by ne-waza. In response, Oda

Table 6. Number and types of participating schools and national champion in each phase.

Phase	Times	Gov/Public HS mean (range)	Gov/Public VS mean (range)	HS+VS mean (range)	UPC mean (range)	Total mean (range)	National champion school
I	1st–7th	3.6 (3–5)	1.1 (1–2)	0	0	4.7 (3–7)	1st-7th: 4th HS
II	8th–11th	7.3 (5–9)	1.5 (1–2)	0	1.5 (1–2)	10.3 (8–13)	8th: 5th HS; 9th–11th: 6th HS
III	12th–20th	18.9 (10–23)	7.2 (4–15)	1.0 (0–4)	2.7 (2–7)	31.4 (16–46)	12th–16th, 20th: 6th HS; 17th–19th: Matsuyama HS
IV	21st–27th	23.1 (22–25)	17.0 (14–21)	7.3 (3–9)	6.0 (3–9)	53.4 (42–60)	21st: Hokkaido IUPC; 22nd,25th,26th: Kangaku HCS; 23rd: Takushoku UPC; 24th: Doshisha HCS; 27th: Matsuyama HCS

Gov: Government, HS: High school, VS: Vocational school, UPC: University preparatory course, IUPC: Imperial university preparatory school, HCS: Higher commercial school.

published his opinion in Chuo-koron (Central Public Opinion), the famous monthly journal, advocating the advantages of *ne-waza* for young students to win the team competition (Oda, 1918; Oda, 1919). Furthermore, several agreements were presented to support Oda's strategy to win the team competition and recognise the students' efforts to contribute towards the victory of the team. In addition, the value of *ne-waza* with pull down techniques against experienced fighters was accepted by many *judoka* (Hirasawa, 1918; Take, 1918). After the 5th competition, the 1st HS decided to abolish this interschool judo competition and declined to participate in the interschool judo tournament from 1921. However, the 2nd HS participated in the KJT for the first time in 1929.

CONCLUSION

During the 27-year period from 1914 to 1940, the KJT established the tradition of *kosen judo*, while developing new fighting strategies with full use of *ne-waza* in team competition. The rate of *katame-waza* in DTIs increased from 31.0 % in 1914 to 91.3 % in 1930, and new *ne-waza* techniques have been developed through the dedicated efforts of HS, VS and UPC students. Their hard training fostered an awareness of fighting spirit in victory at team competitions and honour of their alma mater. These experiences enhanced their friendships with their teammates and contributed to their personal development greatly.

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Adapting the Safe Falling Programme For Arab Populations

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Abstract: *The Safe Falling Programme, originally developed to reduce fall-related injuries among older adults through structured ukemi techniques, has gained increasing relevance in Gulf countries. However, the cultural context of the region, particularly the widespread use of traditional garments such as the thobe and abaya, introduces unique mobility constraints and safety considerations that differ from those assumed in the original programme (Destination KSA, 2015; Destination KSA, 2023). This commentary outlines the conceptual, cultural and practical foundations required to adapt the Safe Falling Programme for Arab populations, with emphasis on developments that began in 2024 and continued through 2025.*

Early adaptation efforts in 2024 involved teaching the programme while wearing the thobe to understand how garment length, looseness and restricted leg movement affected ukemi performance. A demonstration delivered in a thobe at the 2nd International Conference on Safe Falling for Older People through Judo later that year highlighted the absence of gripping points normally provided by a judogi (Hegazi & Elsayed, 2024). This led to a discussion on the Japanese tasuki, a sash used to secure kimono sleeves. In 2025, the majned, a culturally appropriate Gulf accessory, was introduced as an effective adaptation, providing safe gripping points without compromising modesty.

This commentary demonstrates how culturally grounded modifications can enhance safety, acceptance and instructional effectiveness. It provides a framework for integrating traditional clothing considerations into fall-prevention education and contributes to the broader understanding of ukemi-based interventions in diverse cultural settings.

Keywords: *safe falling; ukemi; thobe; abaya; majned; fall prevention*

Ukemi (breakfalls) are core judo skills that protect practitioners by reducing impact forces on the head, neck and axial skeleton. As a disciplined method of 'receiving with the body,' *ukemi* transforms an uncontrolled fall into a co-ordinated, protective movement involving the trunk and the upper and lower limbs. Effective breakfall technique relies on whole-body control rather than neck strength alone, with greater hip, knee and trunk extension shown to act as protective mechanisms (Lockhart et al., 2022). Beyond the dojo, the automatised motor patterns developed through *ukemi* practice translate into practical fall-injury-prevention skills applicable in daily life, making these techniques especially valuable for older adults who face an increased risk of injury from unexpected losses of balance. This reflects core judo principles such as *Jita Kyoei* (mutual welfare and benefit) and *Seiryoku Zenyo* (maximum efficiency with minimum effort).

Rationale for Programme Adaptation

The original Safe Falling Programme, designed to reduce fall-related injuries among older adults through structured *ukemi* techniques, has recently gained attention in Gulf countries. Following the 1st International Conference on Safe Falling for Older People through Judo in late 2023, interest grew in exploring how this programme could be adapted for Arab populations (Hegazi & Elsayed, 2024). The Gulf region presents a unique cultural context, particularly regarding traditional clothing worn by men and women. These garments, while central to cultural identity, introduce mobility constraints and safety challenges that must be addressed when teaching safe falling techniques (Destination KSA, 2015; Destination KSA, 2023). This commentary outlines the conceptual framework, cultural considerations and practical innovations required to adapt the Safe Falling Programme for Arab communities, with particular attention to developments that began in 2024 and continued through 2025.

Cultural Clothing and Mobility Considerations

In Gulf societies, traditional clothing is deeply tied to modesty, identity and daily life. Men commonly wear the thobe; a long, ankle-length robe designed for comfort and climate suitability. Women typically wear the abaya; a long black cloak worn over other clothing. Although culturally significant, these garments influence movement patterns in ways that differ from the flexible sportswear assumed in the original Safe Falling Programme.

The length and looseness of the abaya can restrict stride length, reduce knee lift and limit lateral movement. Lifestyle publications in Saudi Arabia have documented these challenges, noting that abayas may impede comfortable walking and occasionally become entangled during

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daily tasks (Destination KSA, 2015). Similarly, the thobe can restrict rapid movement unless the wearer adjusts or holds the garment manually, which is not always feasible for older adults (Destination KSA, 2023). These observations highlight mobility constraints that must be considered when designing safe falling guidance.

Safety Hazards and Real-World Fall Scenarios

Traditional garments also introduce safety hazards directly relevant to fall-prevention programmes. The flowing fabric of an abaya may catch on door handles, furniture edges, or uneven flooring, increasing the risk of tripping. The thobe can become trapped under the feet during stepping motions or when descending stairs. These hazards mirror real-world fall scenarios in Gulf countries, where older adults often navigate daily environments while wearing these garments. Any fall-prevention programme that does not account for these clothing-related risks would fail to reflect the lived experiences of its participants.

Relevance to Fall Risk in Saudi Arabia

These cultural and clothing considerations align with findings from recent research on fall risk in Saudi Arabia. A study examining the fear of falling among Saudi community-dwelling older adults identified several predictors of increased fear, including sex (being a woman), history of falls, poor health perception, impaired mobility, and sensory deficits (Al Harbi et al., 2025). The study emphasised the importance of culturally appropriate rehabilitation interventions and regular physical activity to reduce the fear of falling and improve functional independence. This reinforces the need for an adapted Safe Falling Programme that respects cultural norms while addressing mobility limitations inherent to traditional clothing.

Beginning the Adaptation: Teaching in Thobes in 2024

In early 2024, efforts began with Fouad Hegazi Sensei to explore how the original Safe Falling Programme could be taught while participants wore traditional Gulf clothing. Initial demonstrations and instructional trials were conducted using the thobe to better understand how fabric length, garment looseness and restricted leg movement affected *ukemi* performance. These early sessions revealed that while the fundamental principles of safe falling could be introduced, several movements required modification. Transitions involving kneeling, squatting or wide stances were particularly affected and instructors noted the absence of normal gripping that would be provided by the wearing of *judogi* (Hegazi & Elsayed, 2024). These observations formed the foundation for a more structured adaptation process.

Demonstration at the 2nd International Conference

A significant milestone occurred later in 2024 during the 2nd International Conference on Safe Falling for Older People through Judo. During a demonstration performed while wearing a traditional thobe, the limitations of teaching *ukemi* without gripping points became especially clear. This demonstration prompted a discussion with Lance Gatling Sensei, who suggested the use of the Japanese *tasuki*, a sash traditionally used to secure kimono sleeves (Hegazi & Elsayed, 2024). This idea marked the beginning of a new phase in the adaptation process, as it offered a practical solution to one of the most persistent challenges encountered during thobe-based instruction.

Innovation in 2025: Introducing the Majned

Following the conference, further exploration was undertaken to identify a culturally appropriate equivalent to the *tasuki* that could be used in Gulf countries. In 2025, the majned, a traditional accessory used in Gulf clothing, was identified as the most suitable adaptation. The majned can be worn comfortably over thobes and abayas and provides secure gripping points without compromising modesty. Its introduction represented a major advancement in the adaptation of the Safe Falling Programme, allowing instructors to support participants safely during kneeling and squatting transitions and enhancing participant confidence. It also served as a meaningful cultural bridge, blending Japanese tradition with Arab values in a way that promoted safety, respect and cultural continuity.

CONCLUSION

Adapting the Safe Falling Programme for Arab populations requires careful consideration of cultural clothing, mobility limitations and safety concerns. The developments that began in 2024 with thobe-based instruction, followed by the 2024 conference demonstration, and culminating in the 2025 introduction of the majned, illustrate a thoughtful and culturally grounded approach to programme adaptation. These innovations provide a foundation for developing a respectful and effective model of *ukemi* instruction that aligns with the lived realities of older adults in Gulf countries. This commentary highlights the importance of culturally informed programme design and sets the stage for future research, collaboration and implementation across the region. Further studies should explore the effectiveness, acceptability and long-term outcomes of these adaptations to strengthen evidence-based fall-injury-prevention strategies in Arab communities.

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