

REVIEW ARTICLE

An Overview of Contemporary Scientific Research into the Physiological and Cognitive Benefits of Judo Practice

REVIEWER

Rod Eadie is a lecturer at Charles Sturt University in the School of Policing Studies and teaches on the Associated Degree of Policing Practice. He formerly held the rank of Senior Constable with the NSW Police Force. He is also a doctoral researcher, using ethnographical research to examine current practice-based methods in the disciplines of self-defence.

ABSTRACT

Jigoro Kano posited that self-improvement could be achieved through judo practice in three distinct ways: improved skill, higher intellect, and moral development; all of which may lead to more productive citizenry. While moral development may be important in martial arts practice, this article provides an overview of the current scientific research into skill acquisition and cognitive benefits of judo practice as hypothesised by Jigoro Kano. Through reviewing selected literature there is evidence to suggest that judo, and other similar martial arts, can improve skill development and cognition through practice. The aim of this review article is to illumine Kano's claims regarding judo as a beneficial practice that leads to an improved self which may enlighten current and prospective practitioners.

DOI

10.18573/mas.160

KEYWORDS

Executive functions, self-improvement, personal development, embodiment, martial arts, judo

CITATION

Eadie, Rod (2023). An Overview of Contemporary Scientific Research into the Physiological and Cognitive Benefits of Judo Practice. *Martial Arts Studies*, 14, 78-82. DOI: 10.18573/mas.160

INTRODUCTION

In the late nineteenth century, Japanese jujutsuan Jigoro Kano developed the martial art of judo which showcased a much less brutal practice than earlier samurai disciplines such as the *taijutsu* and *yawara* schools of Japan [Kano 1915/2005: 18]. Japanese society was developing under Western influence and the archaic practices of the samurai were beginning to fade into the shadows of the social periphery [Ebell 2016: 34]. Being an educator, Kano used his influence to invite students to participate in the dojo (training hall) practicing judo as a complementary educational tool that would assist in accomplishing other tasks outside the dojo [Kano 1915/2005: 34]. Pedagogically speaking, Kano's fusion of martial arts practice with education was rather revolutionary; that is to say, the way that he incorporated the body into education is now recognised by many scholars as *embodied knowledge*. For instance, Perry and Medina [2011: 62] describe this approach as a learning environment that affords students the opportunity to consider bodily senses through practice. Relating this concept to the dojo would mean that the practitioner enters the dojo to inquire into the subjective experience at a pace that is self-directed and in a way that encourages learning and builds upon previous experiences. Gunduz and Hursen [2015] argue that methods such as these encourage a dynamic learning environment, allowing the exploration into an experience that may generate new ideas in a discipline. Linking this learning environment back to Kano illustrates how Kano believed that judo would enable practitioners to capitalise on the lived experience, develop character, and become active citizens [Kowalczyk et al. 2022]. Unfortunately, despite the growing interest in judo, Kano never produced data that substantiated his assertions, for his main objective was to reintroduce martial arts into society with positive associations to education and personal development.

Since judo's rise to prominence in the Olympic games in 1964, research into the practice, along with other martial arts, has become of interest to scholars, particularly through sociology and psychology which are revealing that martial arts do positively influence human flourishing [Croom 2014]. As noted in Ryan and Deci's [2001: 141-142] research, the pursuit of martial arts studies is now an intense discovery into experiences that lead to optimal living and psychological health. Nevertheless, martial arts may also present practitioners with an alternative creative expression that leads to improved psychosomatics [Moore et al. 2018: 6]. These were the inclinations of Kano, and scientific research is now revealing how the sentient being experiences a pedagogical interspersed of 'gut feeling to the intellect' [Bowman 2018: 20], reified through the simultaneity of autopoietic enactivism and internal psychological representations [Haosheng, Jiajia & Dequan 2021: 1394]. When thinking about martial arts more broadly, this means that the art, as experienced and observed by practitioners, is a chief cornerstone in the production of phenomena, which is interconnected to being through creative exploration [Peterson 1999: 62].

While it is not the goal of this article to attempt to fill the gap between cognition and human experience, I am pushed to recognise that cognitive structures and the different pathways for embodied cognition are rooted in human creativity [Finke, Ward & Smith 1992: 2]. And to this, I believe it is necessary to provide a synopsis of these processes for how they relate to scientific evidence that judo practice positively contributes to a better self.

CONTEMPORARY SCIENTIFIC STUDIES INTO THE BENEFITS OF JUDO PRACTICE

Recent neurological studies suggest that judo is an effective physical activity for the development of executive functions, and researchers consider the practice a legitimate method for self-improvement [Amaral & Gabriel 2021]. A study conducted by Valdés-Badilla et al. [2021] of older participants in martial arts (mean age: 69.6 years) reviewed the disciplines of Olympic combat sports (i.e., boxing, fencing, judo, karate, taekwondo, and wrestling), as well as Brazilian jiu jitsu, measuring physical functionality and psychoemotional health. The findings from this study indicate that regular practice of martial arts improves balance, cognitive function, and mental health. To further understand this, Agrawal and Borkar [2021: 155] explain that martial arts demand high levels of cortical recruitment combined with complex repetitive actions that increases alertness and selective attention. In their study, Agrawal and Borkar observed a broader demographic that captured data from 969 martial arts participants aged between 18-40 years. Their systematic review examined the effects of martial arts on attention time span focussing on adults diagnosed with attention deficit hyperactive disorder (ADHD). Results from the study claim that most participants displayed improved coordinated activation and rates of attention, and control over behaviour. In addition to this, Agrawal and Borkar [2021: 152] demonstrated that '[The] positive expectation in terms of sports performance leads to a high level of self-efficacy and that overcome[s] psychological obstacles'. This is essential for two reasons: 1) self-efficacy plays an important role in a person's ability to use discernment, set and achieve goals, assemble ideas, and control emotion [Wilde & Hsu 2019]; and 2) it is important that we understand what helps us to exercise influence over what we do [Wilde & Hsu 2019]. This is best summarised by renowned psychologist Albert Bandura when he said: 'Perceived self-efficacy refers to beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments' [1997: 3].

According to Lambourne and Tomporowski, improvements with executive functions are attributed to steady-state training (a period of continuous exercise), but studies in kinesiology reveal that cognitive task performance can be impaired during acute physical fatigue [2010: 17]. Lethargy may initially impede the cortical recruitment during high intensity exercise, but that appears to be short-term. Overall, Lambourne and Tomporowski [2010: 17] reveal that regardless of the type of physical exercise engaged, participants' executive functions

improved when tested post-exercise. Interestingly, a study on visually impaired judoka, conducted by Almansba et al. [2012], reveals that judo practice improved proprioceptive function (a sense of self-movement) for balance and was thus recommended as a valuable exercise for the development of balance and coordination for the visually impaired [Almansba et al. 2012: 157]. Interestingly, a similar study on the closely related art of Brazilian jiu jitsu (BJJ) examined the effects of BJJ on older participants, revealing that sixty-two male volunteers, non-institutionalised and aged between 60 and 80 years old, were assessed over twelve weeks engaging in BJJ training [de Queiroz et al. 2016]. The treatment intervention consisted of applying BJJ training twice a week. Each 90-minute session was divided into the following stages: (a) 5 minutes of initial stretching, 20 minutes of warm-up with active stretching, and strength exercises; (b) 3 minutes of recovery and rehydration (water only); (c) 50 minutes of BJJ training that included unbalancing (e.g., takedowns and throws), submissions, positions adequate for the skill level of the participants (beginners), and self-defense techniques; and (d) 10 minutes of stretching for cooldown and relaxation [2016: 4]. de Queiroz et al. reported that:

[I]n addition to strength, BJJ was also efficient in promoting an increase in flexibility levels, aerobic endurance, and motor agility/dynamic balance. During BJJ practice, many moves require the use of isometric contraction of lower and upper body muscles, which may lead to neural and somatic adaptations, such as increased motor-units recruitment and muscle hypertrophy. This could explain the increase in strength after intervention in the present study. [2016: 5]

Another study conducted by Belo et al. [2021] aimed at exploring the potential therapeutic effects of BJJ training by assessing blood pressure responses during and after technical sparring. The study consisted of seven BJJ practitioners (age: 24.0±3.5 years; height: 1.75±0.02 m; body mass: 76.0±4.2 kg; BMI: 24.5 0.9) who were required to perform three five-minute technical sparring rounds each day over a two-day period. The study confirmed that technical BJJ sparring induces significant post-exercise decreases in blood pressure which suggests that BJJ can be recommended as a non-pharmacological treatment strategy for the prevention and management of hypertension [Belo et al. 2021: 42]. A much broader study conducted by Johnstone and Marí-Beffa [2018], examining the neurological, physiological, and psychological effects of martial arts training, indicates that martial arts practice creates an excitability of the corticospinal motor system which improves alertness and overall executive functions.

The literature thereby demonstrates that physical activity significantly improves executive functions with both judo and BJJ proving particularly effective. This provides substantial evidence supporting Kano's assumptions that his reformed jujutsu practice would assist practitioners in improving their skill acquisition, intellect, and active, healthy participation in society.

THE IMPORTANCE OF DRILLS AND SPARRING WHEN PRACTICING JUDO

The aim of this section is to illumine Kano's hunches that judo advances self-improvement through an overview of scientific benefits associated with practice variability. I will present this by drawing a distinction between what is referred to as *kata* (sequenced patterns), and *randori* (random practice) [Dodd and Brown 2016] and how they are associated with what is deemed block practice and variable practice theory. I do this to describe how Kano's judo pedagogy, which included repeated practice combined with randomised application, remains relevant in contemporary practice.

Author, Taekwondo master and BJJ practitioner Josh Peacock [2019] has researched the successful application of this breakdown through what is called Variable Practice Theory (VPT). VPT suggests that once a technique is acquired, skill acquisition stands a greater chance of being understood through improvised sparring [Peacock 2019]. In a general sense, this is universally practiced in most judo and BJJ dojos. To demonstrate how this works, the first half of a lesson generally introduces techniques and concepts practiced under compliance with a partner. This is otherwise referred to as 'blocked practice' [Peacock 2019]. These techniques are samples or parts of a combative sequence, isolated from free exchange. The second half of the lesson may actively seek to use those techniques in free sparring which is improvised without compliance. This type of randomised and unscripted practiced is referred to as 'practice variability' which is common to *randori* [Peacock 2019]. A significant number of studies exploring embodied cognition demonstrate that perception and action are interdependent in relation to 'action possibilities', particularly if variability of practice encourages creative sequences in routines and subroutines of skill acquisition [Maldonato 2019: 695]. This means that higher-level decision making for skilled practitioners inducing repetitions of error correction hold a greater probability of skilfully resolving anticipated situations. This is referred to as improvisational execution, not to be confused with an impulsive unfamiliarity, rather, the effective goal-directed behavioural responses to predicted or unforeseen circumstances [Maldonato 2019: 695].

Practice variability provides a deeper conceptual understanding of *kata* and *randori* in terms of the linear and nonlinear processing of information. The blocked approach is more linear, focussing on information processing to encourage action-based sensory feedback, or in other words, sensory inputs that are measured against desired movement outcomes [Crotti et al. 2021]. *Kata* is an example of blocked practice because it requires drilling techniques and engaging the working memory (short term). For example, balance breaking, fitting into position, gripping, and timing of execution train the response inhibitions that suppress actions that are inappropriate in each context and that interfere with goal-driven behaviour [Xu et al. 2020: 2]. *Randori*, on the other hand, is the free exchange of variable practice, which engages

practitioners with a nonlinear approach favouring exploratory learning and the promotion of individualised movement solutions [Crotti et al. 2021]. To complement this transition from linear to nonlinear training, practitioners must also exercise emotional control (or emotional regulation). In other words, poise or restraint would be required for practitioners when under pressure and in compromising positions, allowing them to remain calm and execute techniques with precision [Côté, Gyurak & Levenson 2010]. This is important for following instructions, responding to questions, and comprehending concepts [Chai, Abd Hamid & Abdullah 2018] which Kano believed were all necessary developmental attributes of a mature active citizen.

CONCLUSION

Over the past century, judo theory and practice has maintained the position that practicing martial arts can be linked to improving mind and body and achieving more optimal living. As was mentioned, Kano had great aspirations for judo practice and intuited a theoretical proposition for self-improvement through such practice, although until recently, these claims were never fully proven. Through engaging the literature, such as Valdés-Badilla et al. [2021] on psychology and martial arts practice, as well as Johnstone and Marí-Beffa's [2018] examination into the neuroscientific effects through martial arts practice, there is evidence that confirms those casual links. I drew upon the literature to demonstrate that post-exercise studies for judo reveal improved executive functions, and that both practices are linked to an improved sense of self-improvement. To further investigate how the practice of judo may improve personal development, I drew upon literature that argues that martial arts can be used to positively influence emotions and self-efficacy [Agrawal and Borkar 2021]. The literature also illustrates how martial arts training combined with cognitive demands improves decision making and goal setting. This article contributes to the extant literature on martial arts by giving an overview of the current literature exploring embodied cognition which Kano implicitly stated could be achieved through judo practice.

REFERENCES

- Agrawal, R. & Borkar, P. (2021). Influence of martial art on self efficacy and attention time span in adults: Systematic review. *International Journal of Physical Education, Sports and Health*, 8(3), 151-157. <https://www.kheljournal.com/archives/2021/vol8issue3/PartC/8-2-43-321.pdf>
- Almansba, R., Sterkowicz-Przybycien, K., Sterkowicz, S., Mahdad, D., Boucher, J. P., Calmet, M. & Comtois, A. S. (2012). Postural balance control ability of visually impaired and unimpaired judoists. *Archives of Budo*, 8(3), 153-158. <https://archbudo.com/view/abstract/id/10569>
doi.org/10.12659/AOB.883365
- Amaral, P. M.T. & Gabriel, C. A. (2021). The Contribution of judo to the development of key cognitive skills needed in contemporary society. *The Arts and Sciences of Judo*, 1(1), 60-61.
https://www.researchgate.net/publication/350886196_The_Contribution_of_Judo_to_the_Development_of_Key_Cognitive_Skills_Needed_in_Contemporary_Society
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. W.H. Freeman and Company.
- Belo, W., Castro, L., Palmieri, D., Santos, L., Herrera-Valenzuela, T., Santos, M., Øvretveit, K. & Simão, R. (2020). Post-exercise hypotension in Brazilian jiu-jitsu. *Sport Mont*, 19(1), 39-43.
doi.org/10.26773/smj.210208
- Bowman, P. (2018). Embodiment as embodiment of. In J. Leigh (Ed.), *Conversations on embodiment across higher education: teaching, practice and research* (pp.1-15). Routledge.
doi.org/10.4324/9781315266664-2
- Chai, W. J., Abd Hamid, A. I. & Abdullah, J. M. (2018). Working memory from the psychological and neurosciences perspectives: A review. *Frontiers in Psychology*, 9(401), 1-16.
doi.org/10.3389/fpsyg.2018.00401 PMID:29636715
PMCID:PMC5881171
- Côté, S., Gyurak, A. and Levenson, R. W. (2010). The ability to regulate emotion is associated with greater well-being, income, and socioeconomic status. *Emotion*, 10(6), 923-933.
doi.org/10.1037/a0021156 PMID:21171762 PMCID:PMC4175372
- Croom, A. M. (2014). Embodying martial arts for mental health: Cultivating psychological well-being with martial arts practice. *Archives of Budo*, 10, 59-70. <https://core.ac.uk/download/pdf/131199687.pdf>
- Crotti, M., Rudd, J. R., Roberts, S., Boddy, L. M., Fitton Davies, K., O'Callaghan, L., Utesch, T. & Fowweather, L. (2021). Effect of linear and nonlinear pedagogy physical education interventions on children's physical activity: A cluster randomized controlled trial (SAMPLE-PE). *Children*, 8(49), 1-21.
doi.org/10.3390/children8010049 PMID:33467568
PMCID:PMC7830495
- Dodd, S. & Brown, D. (2016). *Kata: The true essence of Budo martial arts? Revista de Artes Marciales Asiáticas*, 11(1), 3247.
doi.org/10.18002/rama.v11i1.3693
- Ebell, S. B. (2016). Competition versus tradition in Kodokan judo. *Journal of Asian Martial Arts*, 17(1), 28-37.
- Finke, R. A., Ward, T. B. & Smith, S. M. (1992). *Creative cognition: Theory, research and application*. MIT Press.
- Gunduz, N. & Hursen, C. (2015). Constructivism in teaching and learning: Content analysis evaluation. *Procedia - Social and Behavioral Sciences*, 191, 526-533.
doi.org/10.1016/j.sbspro.2015.04.640
- Haosheng, Y. E., Jiajia, S. U. & Dequan, S. U. (2021). The meaning of the body: Enactive approach to emotion. *Acta Psychologica Sinica*, 53(12), 1393-1404.
doi.org/10.3724/SP.J.1041.2021.01393
- Johnstone, A. & Mari Beffa, P. (2018). The effects of martial arts training on attentional networks in typical adults. *Frontiers in Psychology*, 9(80), 1-9.
doi.org/10.3389/fpsyg.2018.00080 PMID:29472878
PMCID:PMC5809487
- Kano, J. (1915/2013). *Mind over muscle: Writings from the founder of judo*. Kodansha International.
- Kano, J. (2013). *Kodokan judo*. Kodansha USA Inc.
- Kowalczyk, M., Zgorzalewicz-Stachowiak, M., Blach, W. & Kostrzewa, M. (2022). Principles of judo training as an organised form of physical activity for children. *International Journal of Environmental Research and Public Health*, 19(4), 1-8.
doi.org/10.3390/ijerph19041929 PMID:35206114 PMCID:PMC8872033
- Lambourne, K. & Tomporowski, P. (2010). The effect of exercise-induced arousal on cognitive task performance: A meta-regression analysis. *Brain Research*, 1341, 12-24.
doi.org/10.1016/j.brainres.2010.03.091 PMID:20381468
- Maldonado, N. M., Oliverio, A. & Esposito, A. (2019). Prefiguration, anticipation, and improvisation: A neurocognitive and phenomenological perspective. In M. L. Cappuccio (Ed.), *Handbook of embodied cognition and sport psychology* (pp. 695-722). The MIT Press.
doi.org/10.7551/mitpress/10764.003.0038
- Moore, B., Dudley, D. & Woodcock, S. (2019). The effects of martial arts participation on mental and psychosocial health outcomes: A randomised controlled trial of a secondary school-based mental health promotion program. *BMC Psychology*, 7(60), 1-7.
doi.org/10.1186/s40359-019-0329-5 PMID:31511087
PMCID:PMC6737629

Peacock, J. (2019, October 9). *How 'variable practice' builds better martial arts skills, faster*. Gymdesk. <https://gymdesk.com/blog/how-variable-practice-builds-better-martial-arts-skills-faster/>

Perry, M. & Medina, C. (2011). Embodiment and performance in pedagogy research: Investigating the possibility of the body in curriculum experience. *Journal of Curriculum Theorizing*, 27(3), 62-75. <https://journal.jctonline.org/index.php/jct/article/view/100>

Peterson, J. B. (1999). *Maps of meaning: The architecture of belief*. Routledge.

de Queiroz, J. L., Sales, M. M., Sousa, C. V., da Silva Aguiar, S., Asano, R. Y., de Moraes, J. F. V. N., Soares, B. R. A., Neves, R. V. P., de Moraes, M. R. & Simões, H. G. (2013). 12 weeks of Brazilian jiu-jitsu training improves functional fitness in elderly men. *Sport Sciences for Health*, 12, 291-295.
doi.org/10.1007/s11332-016-0287-8

Ryan, R. M. & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology* 52, 141-166.
doi.org/10.1146/annurev.psych.52.1.141 PMID:11148302

Valdés-Badilla, P., Herrera-Valenzuela, T., Ramirez-Campillo, R., Aedo-Muñoz, E., Báez-San Martín, E., Ojeda-Aravena, A. & Branco, B. H. M. (2021). Effects of Olympic combat sports on older adults' health status: A systematic review. *International Journal of Environmental Research and Public Health*, 18(14), 1-21.
doi.org/10.3390/ijerph18147381 PMID:34299833 PMCID:PMC8303637

Wilde, N. & Hsu, A. (2019). The influence of general self-efficacy on the interpretation of vicarious experience information within online learning. *International Journal of Educational Technology in Higher Education*, 16(26), 1-20.
doi.org/10.1186/s41239-019-0158-x

Xu, P., Wu, D., Chen, Y., Wang, Z. & Xiao, W. (2020). The effect of response inhibition training on risky decision-making task performance. *Frontiers in Psychology*, 11(1806), 1-9.
doi.org/10.3389/fpsyg.2020.01806 PMID:32793080
PMCID:PMC7393991

ABOUT THE JOURNAL

Martial Arts Studies is an open access journal, which means that all content is available without charge to the user or their institution. You are allowed to read, download, copy, distribute, print, search, or link to the full texts of the articles in this journal without asking prior permission from either the publisher or the author.

The journal is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

Original copyright remains with the contributing author and a citation should be made when the article is quoted, used or referred to in another work.



Cardiff University Press
Gwasg Prifysgol Caerdydd

Martial Arts Studies is an imprint of Cardiff University Press, an innovative open-access publisher of academic research, where 'open-access' means free for both readers and writers.
cardiffuniversitypress.org

Journal DOI

10.18573/ISSN.2057-5696

Issue DOI

10.18573/mas.i

Accepted for publication 12th of September 2023

Martial Arts Studies

Journal design by Hugh Griffiths

Issue layout by Lucy Aprahamian

MAS.CARDIFFUNIVERSITYPRESS.ORG

TWITTER.COM/MASTUDIES

MARTIAL ARTS STUDIES

EDITORS

Paul Bowman
Alex Channon
Lauren Miller
Benjamin N. Judkins
Wayne Wong

EDITORIAL ASSISTANT

Jiongyan Huang

DESIGNER

Lucy Aprahamian

To consider publication or to submit,
consult the guidelines and follow the
instructions for authors at:
mas.cardiffuniversitypress.org

EDITORIAL ADVISORY PANEL

Oleg Benesch *University of York*
Stephen Chan *SOAS*
Greg Downey *Macquarie University*
D.S. Farrer *University of Guam*
Adam Frank *University of Central Arkansas*
Thomas A. Green *Texas A&M University*
T. J. Hinrichs *Cornell University*
Leon Hunt *Brunel University London*
Felipe P. Jocano Jr *University of the Philippines*
Gina Marchetti *Hong Kong University*
Meaghan Morris *The University of Sydney*
Daniel Mroz *University of Ottawa*
Meir Shahrar *Tel Aviv University*
Dale Spencer *Carleton University*
Douglas Wile *Brooklyn College, CUNY*