

Enhancing educational pedagogy in the martial arts and introducing science and engineering

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Traditional martial arts the world over are often equal parts mysticism, secrecy and top-down pedagogy. Much of this is due to the traditional and historical nature of the arts handed down from headmaster to headmaster, secrecy is a competitive advantage, essential to preserving life on the battlefield, and cultural differences. But today, when the martial arts for many are predominantly a social and mental pastime, these methods remain, partly as ideology and partly as an aspirational archetype for participants. These traditional arts remain one of the few untouched by sports science and technology where significant educational opportunities lie.

Introduction

Potentially great insights from science, in particular engineering and biomechanics, can both enhance and finetune these traditional practices, provided the traditional and scientific cultures meet. Like many transdisciplinary activities this meeting of cultures can often encounter with barriers to entry. Early successes that enhance traditional practices and martial arts self-image such as punching force were met with great success, such as early work in measuring force production in the striking arts [1] and continues to be popular. However, works that appear to challenge the world view such as the more mystical elements such as internal strength [2] can be met with outright hostility.

Cultural differences

Traditional martial arts are borne out of Eastern culture and associated scientific traditions. With a broad-brush stroke eastern science tended to be focused on observation whereas the west more deductive [3]. Anecdotally the historical star maps of the Chinese astronomers greatly informed the deductive works of western astronomers working on the laws of planetary motion.

This paper, predominantly through Japanese traditional arts, explores the success and struggles of achieving performance enhancement through video analysis and the teaching of biomechanical concepts.

Further as we look to cultural differences, Hofstede's cultural dimensions [4] reveal differences in hierarchal structures for learning and avoidance of conflict

as large variances between East and West. These all arguably limit the ability to bring new ideas and in particular, deductive reasoning into traditional martial arts, where the preservation of ancient culture is bound in the practice as well [5].

Enhancing traditional learning

The learning of skills over time has given birth to the discipline of skill acquisition [6] where elements of blocked vs. random learning, pressure testing, meditation found in traditional martial arts can be augmented with insights from elite sports. The study of biomechanics can also bring to traditional arts techniques of body alignment, ranges of motion, technique [7], muscular power coupling through the kinetic chain and an understanding of centre of mass and toppling for the throwing arts [8] and perceptions of balance in arts like tai chi [9]. The use of engineering technologies such as video analysis [10], force plates and wearable technology also can offer insights into traditional practice

Conclusions

Probably traditional martial arts is one of the few sporting domains yet to see the influence of sports science and technology enter in a significant way. An understanding of the cultural differences, an attitude of working to enhance traditional practice and looking for the match of where it can enhance the traditional teaching paradigm are likely ingredients for success, further study and to challenge the notion that it takes 20 years to master a technique perhaps?

References

1. Gullett, J. K., & Dapena, J. (2008). A comparison of the reverse and power punches in oriental martial arts. *Journal of sports sciences*, 26(2), 189-196.
2. James, D. (2004). The physics of unraisable body: Ki/Chi development in aikido. *Sport Health*, 22(1).
3. Nakayama, Shigeru (1984) "Academic and scientific traditions in China, Japan, and the west", University of Tokyo Press, Tokyo
4. Hofstede, G., Hofstede, G. J., & Minkov, M. (2005). *Cultures and organizations: Software of the mind* (Vol. 2). New York: Mcgraw-hill.
5. Lowry D, (2016) "A coconut palm in Missouri" in Skoss, D. (2016), *Sword & Spirit* (Vol. 2). BookBaby.
6. Baker, J., & Farrow, D. (2015). *Routledge handbook of sport expertise*. Routledge.
7. James, D., Gibson, T. & Uroda, W., 2005. Dynamics of a swing: A study of classical Japanese swordsmanship using accelerometers, in "The Impact of Technology on Sport", In: Subic, A., Ujihashi, S. (Ed.). ASTA, pp. 355–360.
8. McGinnis, P. M. (2013). *Biomechanics of sport and exercise*. Human Kinetics.
9. Song, R., Lee, E. O., Lam, P., & Bae, S. C. (2003). Effects of tai chi exercise on pain, balance, muscle strength, and perceived difficulties in physical functioning in older women with osteoarthritis: a randomized clinical trial. *The Journal of Rheumatology*, 30(9), 2039-2044.
10. Cui, B. (2016). Analysis of Application of Multimedia Technology in Martial Arts Teaching. In *2016 International Conference on Economy, Management and Education Technology* (pp. 273-276). Atlantis Press.