Tun J Sport Sci Med 2024; 2(3):17-20
10.61838/kman.tjssm.2.3.3
Tunisian Journal of Sports Science and Medicine
Commentary

Video modeling: a vital tool for every sport pedagogue

Omar Trabelsi[1*], Mohamed Abdelkader Souissi[1]

[1] 1Research Unit: Physical Activity, Sport and Health, UR18JS01, National Observatory of Sport, Tunis, Tunisia

*** Corresponding author email address**: omar.trabelsi@issepk.rnu.tn

Received: 2024-08-28 **Reviewed:** 2024-09-24 **Revised:** 2024-09-26 **Accepted:** 2024-09-28 **Published:** 2024-09-30

Abstract

Observational learning, a cornerstone of behavioral theories, suggests that individuals acquire new skills by observing others. This principle is especially pertinent in sport pedagogy, where modeling serves as a crucial instructional tool, enabling educators and coaches to demonstrate techniques effectively. Recent advancements in multimedia technologies, such as 360-degree videos, virtual reality, and augmented reality, have significantly enhanced the potential of observational learning. However, the high costs associated with these advanced technologies limit their widespread accessibility. In contrast, traditional digital video remains a highly effective and accessible method for motor skill modeling. Digital videos offer precise, repeatable demonstrations, thereby aiding learners, including those with special needs, in mastering skills through controlled and repeated observation. This Perspective highlights the role video modeling is nowadays playing in sport pedagogy and strongly advocates for the implementation of best practices to maximize its instructional benefits.

Keywords: *Observational learning, motor learning, multimedia, physical education.*

How to cite this article:

Trabelsi, O., & Souissi, M. A. Video modeling: a vital tool for every sport pedagogue. *Tun J Sport Sci Med*. 2024;2(3):17-20.

1. Introduction

Observational learning, a cornerstone of behavioral theories, advocates that individuals can acquire new skills and behaviors by observing others (1). This concept is most prominently encapsulated in the “social learning theory” (2), which underscores the essential role of modeling in learning. This theory delineates key mechanisms of observational learning, including attention, retention, reproduction, and motivation (3). Attention involves focusing on the modeled behavior, retention is the ability to remember it, reproduction is the capacity to replicate it, and motivation is the willingness to perform it, influenced by anticipated reinforcers (3).

The process of observational learning is significantly influenced by several factors, including the context in which the observation takes place (4). One of the contexts in which observational learning is widely adopted is sport pedagogy (5). Over the past decades, there has been a significant increase in research focused on exploring new modeling methods and upgrading existing ones within sports domains, such as physical education (PE) and athletic training (6). Indeed, if you ask a PE teacher or coach about their most frequently used pedagogical tools, modeling is very likely to top the list (5). Coaches and educators regularly use modeling to demonstrate techniques, strategies, and movements, enabling athletes and students to observe and then replicate the desired actions (7). Modeling an action to learners/athletes, rather than relying solely on verbal instruction, offers significant instructional benefits (7). It provides a clear example of expectations, reduces ambiguity, and enhances comprehension by harnessing visual and kinesthetic learning modalities (8).

At the core is the mirror neuron system, with neurons in the premotor cortex and inferior parietal lobule activating both when the student/athlete is performing and observing an action (9). This system enables internal simulation and imitation of observed actions. The visual cortex processes the observed action, relaying information to the motor cortex for planning and execution, creating a visual-motor link for accurate replication (10). In simpler terms, the mirror neuron system helps us learn by watching others. When we see someone perform an action, our brain activates the same areas as if we were doing it ourselves, which helps us understand and imitate their movements. Furthermore, procedural memory, mediated by the basal ganglia, benefits from clear visual representations, allowing for better encoding and refinement of motor patterns (11). It is the type of memory that helps us remember how to perform tasks, such as typing driving a car or riding a bike. The superior temporal sulcus integrates visual and motor information, aiding in understanding the intention behind movements, crucial for learning complex actions (12). More interestingly, observing models engages multiple brain regions. The occipital lobes are involved in visual processing (13), the parietal lobes assist with spatial awareness (14), and the frontal lobes play a role in movement planning (15). This results in a comprehensive neural representation of the action. Understanding these principles allows sport pedagogues to implement observational learning effectively in practice settings, ultimately improving athlete outcomes.

2. Multimedia in skill modeling

Advancements in modeling technologies began in the 19th century with the introduction of photographs (16) and have continued into the present age of advanced multimedia. As a result, the effectiveness of observational learning has undergone a revolutionary leap. Nowadays, many multimedia tools are being used to shift the responsibility of demonstrating a motor skill from the teacher/coach or a more-skilled peer in a live setting to a user-friendly, controlled digital environment. Starting with motion pictures and analog videos, advancements in modeling technologies have continued to evolve. These have progressed to digital videos (17), 360-degree videos (18), virtual reality (19), and augmented reality (20). As a result, researchers studying skill acquisition in sports and PE have increasingly shifted their focus. They have moved from in-vivo modeling to multimedia-based modeling, driven by the superior potential of multimedia tools in enhancing teaching and coaching effectiveness (21). Motion pictures and analog videos, as described by Wilson (17), were among the earliest forms of media used for visual demonstration of skills. These methods required basic equipment such as film projectors and videotape players, providing learners with a reference model to imitate. However, they lacked interactivity and the capacity for immediate feedback. The advent of digital technology revolutionized this approach by making videos more accessible and easier to distribute. Digital cameras, computers, and editing software became essential tools, increasing the availability of instructional content and enabling more sophisticated editing and analysis (21).

Building on this, 360-degree videos offer an immersive panoramic view. These require specialized 360-degree cameras and compatible viewing devices, allowing learners to observe skills from multiple angles and enhancing their spatial awareness and understanding of complex movements (18). Virtual reality (VR) takes immersion a step further. It requires VR headsets, motion sensors, and compatible software to create an interactive environment. In this setting, learners can practice skills in a simulated yet realistic space. The added benefits of VR include immediate feedback and the ability to repeat tasks without real-world consequences, enhancing the learning experience (19). Augmented reality (AR) complements these advancements by overlaying digital information onto the real world. AR devices such as advanced smartphones, tablets (with specialized cameras and sensors), or specialized AR glasses are required, offering contextual guidance and feedback in real-time as learners perform motor tasks, thereby enhancing learning through immediate corrections and suggestions (20).

3. Digital video: optimal tool for modeling

The implementation of advanced multimedia tools such as 360-degree videos, VR, and AR for teaching and learning purposes faces several significant barriers, the most critical of which are cost and budget constraints (18, 22). The devices and software required for these multimedia solutions are often prohibitively expensive, which limits their accessibility for PE teachers and coaches (18, 22) This is especially true for those operating in socio-economically disadvantaged environments (23). Beyond accessibility, there is also the issue of usage literacy (24), which may be more limited with VR and AR. In contrast, the user-friendly nature of video makes it an ideal solution, as it is easier to implement and requires less specialized training.

Between the low technical performance of obsolete motion pictures and analog videos and the limited accessibility of advanced multimedia solutions, traditional digital video stands out as a readily accessible technology. Even with low-cost materials, digital video offers a practical and effective means for enhancing motor skill acquisition (21). Indeed, in the academic community, the term “video modeling” typically refers to the process of observing an expert model performing in flat two-dimensional (2D) digital video sequences on screen-based devices such as smartphones, tablets, and laptops. These devices are easily available in schools and athletic coaching communities, owing to their ubiquitous presence in daily life worldwide

(24). For example, a study conducted by Trabelsi et al. (24) revealed that 75.7% of the participating PE teachers use smartphones, 47.2% use laptops, and 32.5% use tablets with varying frequencies as part of their teaching practices. This widespread availability makes these devices accessible tools for playing, editing, and producing digital videos for various instructional purposes, including skill modeling.

A substantial body of research supports the effectiveness of digital video modeling as a pedagogical tool for motor skill acquisition (25-28). This includes applications for learners with special needs, such as children diagnosed with significant disabilities (29), moderate intellectual disabilities (30), and autism spectrum disorder (ASD) (31). These studies have compared video modeling to live modeling and have consistently found significant improvements in learning outcomes when video modeling is integrated into the instructional process. Video modeling enables more precise demonstration of target motor skills (32). Videos can be carefully produced to show sequential steps, timing, body mechanics, and subtleties involved in executing a motor skill effectively (13). Achieving the same level of control over the model in live demonstrations is challenging due to variability in quality and execution. This variability can be influenced by factors such as the skill level and modeling strategy of the demonstrator (33), environmental conditions, and unexpected interruptions (34). Most importantly, video modeling provides opportunities for repeated viewing and grants learners control over the content (28), essential for motor learning and memory consolidation (35). Learners can watch the video multiple times, enabling them to thoroughly observe, encode, and internalize the modeled skill (35). This repeated exposure enhances skill retention and proficiency by reinforcing neural pathways, consistent with neuroplasticity principles emphasizing the brain's adaptation through practice (36).

In conclusion, modeling through digital videos stands out as an optimal and accessible tool in sport pedagogy, offering substantial benefits for motor skill acquisition and improved learning outcomes. While some studies suggest that moving beyond digital video to VR and AR may offer additional instructional benefits, they also acknowledge the complexity of learning environments involving these advanced tools (20, 37), particularly when compared to the more straightforward implementation of video-based modeling. However, the effective use of video modeling also requires adherence to best practices. It is not merely about utilizing video modeling; it is about maximizing its potential. The successful implementation of video modeling in sport pedagogy hinges on a comprehensive approach that goes beyond mere usage. Therefore, a thorough literature review is needed to compile scientific evidence on how sport pedagogues can best leverage video modeling to enhance instructional outcomes.

Acknowledgments

Not applicable.

Availability of Data and Materials

Not applicable.

Ethical Approval and Consent to Participate

Not applicable.

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no conflict of interest to disclose.

Funding

This research received no specific grant from any funding agency.

Authors' Contributions

Authors equally contributed to this paper.

Declaration

AI chatbots were used to improve the academic English of this manuscript.

References

1. Deguchi H. Observational learning from a radical-behavioristic viewpoint. Behav Analyst. 1984;7:83-95. [PMID: 22478602] [PMCID: PMC2741741] [DOI]
2. Bandura A. Social foundations of thought and action. Englewood Cliffs, NJ, USA: Prentice Hall; 1986. 23-8 p
3. Bandura A. Social foundations of thought and action. Englewood Cliffs, NJ. 1986;1986(23-28):2.

4. Beauprez S-A, Toussaint L, Bidet-Ildei C. When context modulates the influence of action observation on language processing. PLoS One. 2018;13(8):e0201966. [PMID: 30089168] [PMCID: PMC6082549] [DOI]
5. Horn RR, Williams AM. Observational learning: Is it time we took another look? Skill acquisition in sport. 2004:199-230.
6. Han Y, Syed Ali SKB, Ji L. Use of observational learning to promote motor skill learning in physical education: a systematic review. Int J Environ Res Public Health. 2022;19(16):10109. [PMID: 36011744] [PMCID: PMC9407861] [DOI]
7. Choo L, Novak A, Impellizzeri FM, Porter C, Fransen J. Skill acquisition interventions for the learning of sports-related skills: a scoping review of randomised controlled trials. Psychol Sport Exerc. 2024;72:102615. [PMCID: 38401870] [DOI]
8. Al-abood SA, Davids K, Bennett SJ. Specificity of task constraints and effects of visual demonstrations and verbal instructions in directing learners' search during skill acquisition. J Mot Behav. 2001;33(3):295-305. [PMID: 11495834] [DOI]
9. Carcea I, Froemke RC. Biological mechanisms for observational learning. Curr Opin Neurobiol. 2019;54:178-85. [PMID: 30529989] [PMCID: PMC6361711] [DOI]
10. Gutteling TP, Petridou N, Dumoulin SO, Harvey BM, Aarnoutse EJ, Kenemans JL. Action preparation shapes processing in early visual cortex. J Neurosci. 2015;35(16):6472-80. [PMID: 25904798] [PMCID: PMC6605225] [DOI]
11. Wise SP. The role of the basal ganglia in procedural memory. Seminars in Neuroscience. 8. San Diego: Academic Press; 1996. p. 39-46[DOI]
12. Nakahara H, Doya K, Hikosaka O. Parallel cortico-basal ganglia mechanisms for acquisition and execution of visuomotor sequences-a computational approach. J Cogn Neurosci. 2001;13(5):626-47. [PMID: 11506661] [DOI]
13. Oosterhof NN, Wiggett AJ, Diedrichsen J, Tipper SP, Downing PE. Surface-based information mapping reveals crossmodal vision-action representations in human parietal and occipitotemporal cortex. J Neurophysiol. 2010;104(2):1077-89. [PMID: 20538772] [PMCID: PMC2934920] [DOI]
14. Colby CL, Duhamel JR. Spatial representations for action in parietal cortex. Cogn Brain Res. 1996;5(1-2):105-15. [PMID: 9049076] [DOI]
15. Nelissen K, Luppino G, Vanduffel W, Rizzolatti G, Orban GA. Observing others: multiple action representation in the frontal lobe. Science. 2005;310(5746):332-6. [PMID: 16224029] [DOI]
16. Rosenblum N. A world history of photography. New York: Abbeville Press Publishers; 2007.
17. Wilson BD. Development in video technology for coaching. Sports Technol. 2008;1(1):34-40. [DOI]
18. Rosendahl P, Wagner I. 360° videos in education - A systematic literature review on application areas and future potentials. Educ Inf Technol. 2024;29(2):1319-55. [DOI]
19. Neumann DL, Moffitt RL, Thomas PR, Loveday K, Watling DP, Lombard CL, et al. A systematic review of the application of interactive virtual reality to sport. Virtual Reality. 2018;22(3):183-98. [DOI]
20. Soltani P, Morice AH. Augmented reality tools for sports education and training. Comput Educ. 2020;155:103923. [DOI]
21. Jastrow F, Greve S, Thumel M, Diekhoff H, Süßenbach J. Digital technology in physical education: a systematic review of research from 2009 to 2020. Ger J Exerc Sport Res. 2022;52(4):504-28. [DOI]
22. Zhao X, Ren Y, Cheah KSL. Leading virtual reality (VR) and augmented reality (AR) in education: bibliometric and content analysis from the Web of Science (2018-2022). Sage Open. 2023;13(3):21582440231190821. [DOI]
23. Alalwan N, Cheng L, Al-Samarraie H, Yousef R, Ibrahim Alzahrani A, Sarsam SM. Challenges and prospects of virtual reality and augmented reality utilization among primary school teachers: a developing country perspective. Stud Educ Eval. 2020;66:100876. [DOI]
24. Trabelsi O, Bouchiba M, Souissi MA, Gharbi A, Mezghanni N, Kammoun MM, et al. Technology-mediated physical education teaching practices in Tunisian public schools: A national teacher survey. Sport Educ Soc. 2022;27(7):878-92. [DOI]
25. Blagus R, Leskošek B, Okršlar L, Vreček N, Debevec T. Utility of video analysis and expert modelling for technique development in novice sport climbers: a randomized controlled study. Int J Sports Sci Coach. 2024;19(1):355-67. [DOI]
26. Mohammad M, Boushehry H, Reda H. The influence of using video media on basic movement skills in kindergarten education. Educ Inf Technol. 2023;28(8):9635-54. [DOI]
27. Rekik G, Belkhir Y, Jarraya M. Searching to improve learning from complex animated basketball scenes: when decreasing the presentation speed is more efficient than using segmentation. Technol Pedagog Educ. 2021;30(3):393-407. [DOI]
28. Trabelsi O, Gharbi A, Souissi MA, Mezghanni N, Bouchiba M, Mrayeh M. Video modeling examples are effective tools for self-regulated learning in physical education: Students learn through repeated viewing, self-talk, and mental rehearsal. Eur Phys Educ Rev. 2022;28(2):341-60. [DOI]
29. Cannella-Malone HI, Mizrachi SB, Sabielny LM, Jimenez ED. Teaching physical activities to students with significant disabilities using video modeling. Dev Neurorehabil. 2013;16(3):145-54. [PMID: 23477636] [DOI]
30. Obrusnikova I, Rattigan PJ. Using video-based modeling to promote acquisition of fundamental motor skills. J Phys Educ Recreat Dance. 2016;87(4):24-9. [DOI]
31. Judge JP, Morgan KN, Clifton A. Video modeling to support physical activity in children with autism spectrum disorder: a systematic review. J Am Acad Spec Educ Prof. 2022;48.
32. Lhuisset L, Margnes E. The influence of live- vs. video-model presentation on the early acquisition of a new complex coordination. Phys Educ Sport Pedagogy. 2015;20(5):490-502. [DOI]
33. Buchanan JJ, Dean N. Consistently modeling the same movement strategy is more important than model skill level in observational learning contexts. Acta Psychol. 2014;146:19-27. [PMID: 24361741] [DOI]
34. Lambert CT, Guillette LM. The impact of environmental and social factors on learning abilities: a meta-analysis. Biol Rev. 2021;96(6):2871-89. [PMID: 34342125] [DOI]
35. Post PG, Aiken CA, Laughlin DD, Fairbrother JT. Self-control over combined video feedback and modeling facilitates motor learning. Hum Mov Sci. 2016;47:49-59. [PMID: 26874750] [DOI]
36. Dayan E, Cohen LG. Neuroplasticity subserving motor skill learning. Neuron. 2011;72(3):443-54. [PMID: 22078504] [PMCID: PMC3217208] [DOI]
37. Thatcher B, Ivanov G, Szerovay M, Mills G. Virtual reality technology in football coaching: barriers and opportunities. Int Sport Coach J. 2020;8(2):234-43. [DOI]