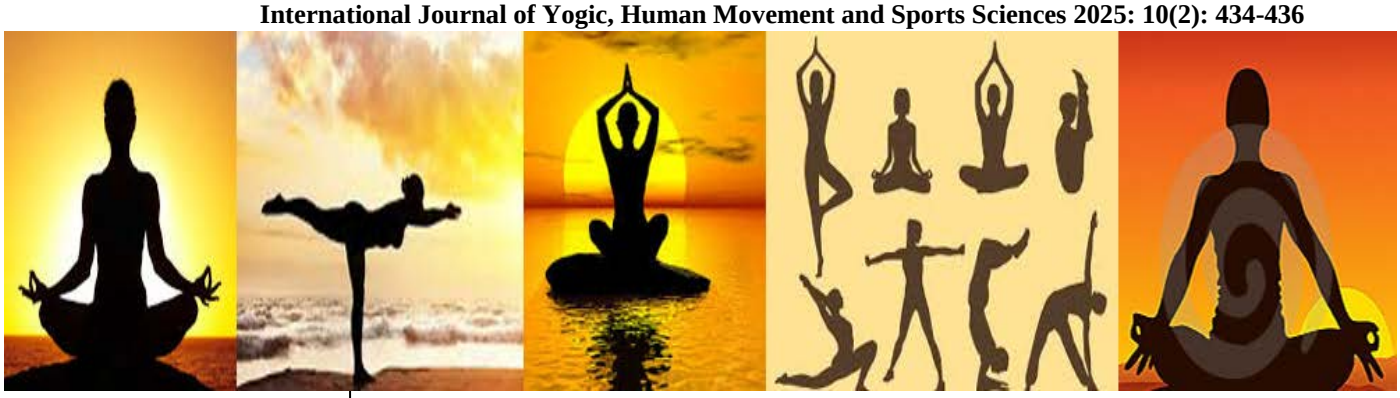

ISSN: 2456-4419
Impact Factor: (RJIF): 5.88
Yoga 2025; 10(2): 434-436

www.theyogicjournal.com
Received: 19-08-2025
Accepted: 22-09-2025

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Importance of digital technology in developing kinesthetic learning

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DOI: https://www.doi.org/10.22271/yogic.2025.v10.i2f.1817

Abstract
The rapid integration of digital technology into educational systems has transformed traditional learning environments, providing innovative pathways for developing kinesthetic learning learning through movement and physical interaction. This paper explores the pivotal role of digital tools such as virtual reality (VR), augmented reality (AR), simulation-based learning platforms, and interactive touch-based interfaces in enhancing kinesthetic engagement among learners. By bridging sensory experience with conceptual understanding, digital technologies help learners visualize abstract concepts, manipulate virtual objects, and engage in experiential learning beyond the constraints of physical classrooms. Furthermore, the study examines how wearable devices and motion-sensing technologies enable personalized feedback and skill-based training, particularly in fields like engineering, medicine, and physical education. The paper also highlights pedagogical frameworks that integrate digital kinesthetic activities to improve motor coordination, retention, and cognitive performance. Overall, digital technology serves as a catalyst in promoting active participation, collaboration, and deeper understanding, thus redefining kinesthetic learning in the 21st-century education landscape.

Keywords: Digital technology, kinesthetic learning, virtual reality (VR), augmented reality (AR), experiential learning, motion-sensing, interactive education, skill-based training, cognitive engagement, 21st-century pedagogy

Introduction
The technological race taking place in the world today, across all scientific and practical fields, and the unprecedented development witnessed worldwide thanks to the introduction, development, and use of technology in various aspects of life, has made technology of great importance and a fundamental pillar of society, especially since it has become synonymous with and linked to most services, both scientific and life-related. Technology has permeated our lives to a very large extent, and we note today that societies have reached the point of inability to dispense with technology, its technologies, and the services it provides to all of humanity (Essa *et al*., 2023) [3].
Digital technology has a significant role in the field of kinesthetic learning. It has provided numerous services that facilitate and accelerate the learning process, making it an enjoyable, active, and engaging process for learners. It has uniquely assisted learners in facilitating the process of acquiring and obtaining scientific information that helps advance skill performance (whether practical or theoretical). It has also enabled them to obtain a greater amount of scientific information and knowledge and access reliable information sources with less effort, cost, and time (Shorey *et al*., 2021) [12].

What is technology and digital technology?
Technology
Technology is defined as the investment of knowledge and the application of knowledge to achieve the desired goals of societal progress and development.
Mahadevkar *et al*., 2022 [6], states, "Technology is all methods that assist researchers and learners in their discoveries and inventions to fulfill their scientific needs and desires for development."
As Oyebola Olusola Ayeni *et al*. (2024) [9] states, "It is the methods of using scientific discoveries and activating them to serve development in various scientific and practical fields."

Digital technology

Sailer *et al*. (2021) [11] defines it as "the mechanisms and methods through which devices and tools are managed digitally."

Mhlongo *et al*. (2023) [7] also defines it as "the technology that encodes and converts data (text, figures, images, videos, and sounds) into digital strings represented by zeros and ones so that they can be processed automatically." Clark-Wilson *et al*. (2020) [2] also states, "Digital technology is technology based on digital technologies (digitization) that is used in the field of learning and teaching, relying on reducing information to numbers stored on computers so that teachers and learners can benefit from it and access it at any time and place according to the educational need."

The importance of technology in the field of education and the educational process has crystallized through many aspects. It has contributed to the development of the educational system as a whole, and the reflection of this development was clearly evident in the improvement of teachers' performance. It has also contributed to the development of teaching methods for the learning process and the teaching methods used in the learning process. It has enabled teachers to use and integrate more than one teaching method in a single educational situation or a single class (when teaching the required skills) (Hassan *et al*., 2021) [4]. Digital technology has also increased learner participation and enhanced their interaction during the learning process. Digital technology is also of great importance and benefit to the educational process during epidemics (such as the COVID-19 pandemic). One of the goals of digital technology is to facilitate the process of obtaining information and the ability to access this information at any time, which enhances the greatest possible benefit in the learning process for the desired educational situation (whether kinaesthetic or mental). Digital technology is more efficient and better organized than traditional educational media, which have become unable to keep pace with modern learning requirements and the aspirations and needs of learners. Digital technology is like an engine or spark that stimulates imaginative abilities. For learners, this leads to the development of their abilities to analyze, infer, and solve problems in the best and fastest ways. It also helps learners integrate and participate with others in various activities, which contributes to enhancing interaction among learners and raising their level of creativity (Spiteri & Chang Rundgren, 2020) [3].

One of the most important advantages of digital technology is that it provides learners with comprehensive learning that encompasses all aspects of the skills being learned and the physical, mental, and behavioral capabilities required by those skills (Chandrabhatla *et al*., 2022) [1]. Digital technology provides learners with new opportunities to develop their physical and mental capabilities. A learner in the age of digital technology possesses better communication skills and abilities, and their duties differ from those in the past. We note that learners are characterized by many traits and characteristics, the most important of which are:
(Pustišek *et al*., 2021) [10]

- Active interaction with a technology-based learning style and digital literacy.
- Active interaction with colleagues during the learning process in the educational setting of the skills being learned.
- The ability to establish positive partnerships with colleagues and effectively exchange knowledge with them.
- Benefiting from the teacher and their expertise more effectively.
- Competing positively with peers during the learning process.
- Possess the ability to self-correct mistakes.
- Possess the ability to correct colleagues' mistakes and provide positive support.
- Awareness of movements and skills and the skill-related and tactical aspects surrounding them (individual technique for performing the skill and collective tactics for performance).
- The ability to continuously learn and innovate.
- The ability to adapt to various educational circumstances and situations.
- The ability to continuously add and update.

From the above, we conclude that digital technology plays a prominent and effective role in developing and enhancing motor learning in the sports field. Technology's role can be positive in several ways, including:

-Virtual simulation: "The use of applications and software that provide virtual simulation experiences of physical activities, helping learners enhance their understanding of the required motor task and develop the required skills without having to actually participate in the required activity" (Müller & Wagner, 2025) [8].

- **Audio-visual technologies:** The use of animated images and analytical video clips to analyze learners' performance.
- Augmented and virtual reality technologies.
- Online learning and distance learning.
- **Sensors and trackers:** Such as heart rate monitors, smart watches, and wearable devices that provide accurate information about learners' performance and the physiological changes that occur during performance.
- Interactive applications and sports programs for exercises and sports skills, as well as general health and fitness applications (Komaini *et al*., 2021) [5].

The researcher adds that digital technology has become a necessity for learning in general and in the field of motor learning in particular, as it has a prominent role not only in learning motor skills but also in mastering those skills and bringing them to advanced and professional levels. He also believes that digital technology has recently played a prominent role in raising the mental level and mental abilities of learners, as it has been noted that there has been a clear development in the planning level and the implementation of planning skills to the fullest extent.

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