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Using Technology in Teaching Motor Skills and Providing Feedback to learners (Systematic Review)

DR.MABROUK MEFTAH[1], ALI TEBBANI[2], AISSA BRAHIMI[3]
[1]INDEPENDENT RESEARCHER, BISKRA, ALGERIA. MABROUKMEFTAH@YAHOO.COM
[2]UNIVERSITY OF M'SILA . ALI.TABBANI@UNIV-MSILA.DZ
[3]UNIVERSITY OF M'SILA . AISSA.BRAHIMI@UNIV-MSILA.DZ

Abstract

Integrating technology into educational paradigms has significantly transformed instructional effectiveness and delivery methods. Within the field of physical education and sports science, leveraging digital tools has emerged as a critical mechanism for accelerating motor skill acquisition and enhancing student performance. The contemporary information revolution presents substantial challenges for educators and stakeholders tasked with navigating rapidly evolving pedagogical landscapes. To foster an adaptable, knowledge-based society, educational curricula must continuously evolve to systematically integrate digital assets. Consequently, this study explores the paradigm shift from traditional teaching methods to technology-driven physical education, focusing on how these tools refine motor control and optimize feedback delivery systems.

Keywords: Technology, Motor Skills, Feedback.

1. Introduction

The use of technology has a significant impact across various fields. In our study, we sought to examine the impact of technology in the field of physical education and sports, specifically on the development of motor skills and the enhancement of performance among secondary school students.

The information revolution and the growing use of educational technology in our current era pose a challenge to educators and those responsible for the educational process in light of these developments. This requires every society that seeks to develop and improve this process to keep pace with the information age—not only in terms of scientific advancements and remarkable technologies, but also in terms of the rate at which they occur, their impact on our lives, and their contribution to transforming society from the industrial age to the information age. Therefore, we must develop our educational curricula to keep pace with these developments.

2. Technological Tools

2.1. Theoretical Framework of Technology

The term "technology" originates from the Greek words Techne (denoting skill, craft, or artistry) and Logos (meaning science, art, or study). Etymologically, it signifies the systematic study or logic of skills applied to execute specific functions.

In the academic literature, technology is defined through various dimensions:

- **Human Expertise Organization:** It represents the structured organization of human expertise through highly efficient, logical methods to harness environmental resources for practical benefits. In this context, neither an isolated method nor a standalone machine constitutes technology independently.

- **Process and Product Triad:** Technology encompasses three functional dimensions:

1.Technology as Processes: The systematic application of scientific knowledge.

2.Technology as Products: The tangible tools, devices, and materials resulting from scientific applications.

3.Technology as an Integrated System: The simultaneous interaction of both processes and products (e.g., computing technologies).

- **Systems-Based Integration:** It is further conceptualized as an integrated educational science that applies hardware (instructional equipment) and software (pedagogical programs) to optimize the teaching-learning paradigm.

2.2. Taxonomy of Technological Instructional Aids

Instructional technologies utilized in pedagogical settings are classified into three primary categories:

- **Auditory Aids:** Tools relying on sound perception, such as language laboratories, audio recordings, and educational radio broadcasts.
- **Visual Aids:** Mediums relying on visual processing, including traditional blackboards/whiteboards, transparencies, physical models, illustrative diagrams, posters, and maps.
- **Audiovisual Media:** Integrated systems combining sight and sound, such as educational films (still and motion), multimedia projectors, video cassette recorders (VCRs), and digital animations.

2.3. Technology-Driven Assessment

The integration of technology into educational evaluation enhances the flexibility, precision, and customization of assessment protocols, effectively aligning them with the distinct individual needs of both learners and instructors.

2.4. The Role of Technological Tools in Motor Skill Acquisition and Feedback Optimization :

2.4.1. Pedagogical Significance of Educational Technology in Physical Education

Integrating advanced technological tools into Physical Education (PE) paradigms significantly enhances instructional efficacy through various pedagogical mechanisms:

- **Enhanced Learner Motivation:** Visual and interactive media foster active engagement, stimulating learners' interest and positive behavioral tendencies.
- **Biomechanical and Motor Analysis:** Digital tools enable precise movement comparison and detailed motor analysis, establishing robust motor perception.
- **Optimization of Skill Acquisition:** Technology facilitates consistent skill performance, reduces instructional and demonstration errors, and optimizes retention while maximizing instructional time efficiency.
- **Scalability and Inclusivity:** These tools allow for the effective management and instruction of large groups through diverse, multi-resource learning environments.

2.4.2. Methodological Evidence from Prior Studies

Empirical literature robustly supports the integration of technology over traditional pedagogical methods in sports science:

- **Abdullah (1995):** Evaluated the impact of technological tools (video systems, television, computing technologies, and standardized cognitive/skill tests) on basketball skill acquisition. The experimental findings demonstrated that technology-driven instruction significantly outperformed traditional methods, yielding superior cognitive and motor skill outcomes.
- **Sami (2001):** Investigated the efficacy of dynamic video feedback compared to sequential photographs and physical models in middle-school gymnastics. The study concluded that video-based instructional interventions provided the highest rate of skill performance improvement.

2.4.3. Technology as an External Source of Feedback

Instructional technologies alleviate student boredom and elevate pedagogical efficiency by serving as rich, multi-sensory channels of feedback. In PE environments, these technologies channel feedback through three primary modalities: external visual feedback, auditory feedback,

and biological (internal/self) feedback.

3. Motor Skills and Feedback

Motor Skills Paradigm in Secondary Education

3.1. Conceptual Framework of Motor Skills

A motor skill is defined as the structural or behavioral component of a movement—or a systematic cluster of fundamental movements—executed precisely to effectively navigate a given athletic scenario. Mastery is characterized by achieving predefined movement objectives with a high degree of motor precision and economy of effort.

3.2. Determinants of Motor Performance

Motor control and movement execution are governed by a multi-faceted matrix of factors:

- **Physiological Determinants:** The functional integrity and efficiency of the circulatory, respiratory, nervous, muscular, and skeletal systems directly dictate athletic performance limits.
- **Psychological Variables:** Cognitive states, emotional regulation, and psychological preparation heavily influence performance precision. Proper anxiety management and fear mitigation are essential for optimal skill execution.
- **Environmental and Socio-Cultural Contexts:** Ambient conditions (e.g., extreme temperatures) impose seasonal and structural constraints on physical activity, alongside the socio-technological evolution of the learner's environment.
- **Genetic and Pathological Variables:** Inherited genetic traits establish baseline motor capacities, while acute or chronic medical conditions can significantly restrict or impair mobility and physical performance.

3.3. Foundations of Motor Learning in PE Curricula

Motor learning occurs effectively when physical activity is transformed into a structured, positive educational experience aligned with academic goals. This process encompasses both autonomous exploration and directed learning. To optimize this, secondary school PE curricula must provide diverse athletic exposure tailored to individual differences, thereby maximizing student potential and fostering scientific, structured thinking.

4. The Mechanism of Instructional Feedback

4.1. The Cybernetic Loop of Feedback

In sports pedagogy, feedback operates as a continuous, dynamic loop during the motor acquisition process:

1.**Goal Identification:** The learner establishes a cognitive model of the target movement via teacher descriptions, demonstrations, or multimedia illustrations.

2.**Motor Response Generation:** The learner executes a sequence of physical movements aimed at achieving the target objective.

3.**Outcome Evaluation:** The results are assessed subjectively (via intrinsic proprioceptive senses) and externally (via instructor critiques, peer evaluations, or video replays).

4.**Error Detection:** The learner compares the achieved outcome against the baseline goal to quantify the performance deficit.

5.**Behavioral Adjustment:** Armed with this comparative data, subsequent motor attempts are systematically modified to align closer with the objective.

4.2. Pedagogical Functions of Feedback

Feedback serves three primary pillars within instructional theories: acting as an informational guide to reinforce or alter responses, serving as a psychological motivator to sustain effort, and functioning as a positive/negative reinforcer.

4.3. Empirical Impact on Skill Accuracy

A pivotal study by Muhammad et al. (2018) evaluated various feedback modalities on handball skills (passing, shooting, and attentional focus) among high school students. The empirical results demonstrated statistically significant improvements across three experimental paradigms:

- **Immediate Verbal Feedback:** Significantly enhanced passing and shooting accuracy between pre- and post-tests.
- **Delayed Visual Feedback:** Demonstrated robust improvements in motor execution and attention focus.
- **Combined Modalities (Immediate Verbal + Delayed Visual):** Yielded the highest statistically significant gains in skill accuracy and cognitive focus compared to control groups.

5. CONCLUSION

This systematic review underscores the profound impact of integrating technological tools within physical education and sports paradigms. The synthesized literature demonstrates that digital hardware and software solutions not only accelerate motor skill acquisition among secondary school students but also fundamentally optimize instructional feedback loops. By transforming traditional, purely verbal teaching styles into multi-sensory, data-driven learning experiences, educational technology bridges the gap between theoretical sports science and practical field execution, paving the way for superior pedagogical outcomes.

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