International Journal of Physical Education and Sports Sciences
Vol. 11, Issue No. 18, (Special Issue) January-2017, ISSN 2231-3745

Biomechanical Foundations of Physical Education and Sports

Dr. Jayaram Maraditot*

Physical Education Director, TMAE Bed College, Ganagavati

Abstract – Physical educators teach a wide variety of human movements, and biomechanics provides a rationale critical for evaluating technique and prescribing intervention to help young people improve. Biomechanics also allows physical educators to identify exercises and physical activities that contribute to the physical development of various muscle groups and fitness components. This chapter illustrates how biomechanical knowledge and the nine principles of biomechanics can be integrated with other sport sciences in qualitative analysis of human movement. Five skills commonly taught in physical education are discussed, and the various tasks of qualitative analysis Real movement performances and typical teaching cues are used to show how biomechanics is applied to real-world physical education. Qualitative analysis is a critical evaluative and diagnostic skill that can be employed for improvement of movement in physical education. Biomechanics provides knowledge relevant to all four tasks of qualitative analysis. an elementary physical educator planning a lesson on kicking as a lead-up to soccer, so you are involved in the preparatory task of qualitative analysis. In preparing to teach and qualitatively analyze kicking, you list the critical features and teaching points of the movement. Students practice this skill, you are planning to evaluate these critical features and diagnose student performance using biomechanical principles. Which biomechanical principles seem most relevant to the critical features of high-speed place-kicking.

----------♦----------

WHAT IS BIOMECHANICS?

Biomechanics has been defined as *the study of the movement of living things using the science of mechanics* (Hatze, 1974). Mechanics is a branch of physics that is concerned with the description of motion and how force screate motion.

What is the value of biomechanics for physical education, exercise science, and sport?

Explain the meaning of mechanical principles and concepts that relate to motion, stability, leverage, and force. How are these used in sport techniques and physical skills?

Kinesiology is the term referring to the whole scholarly area of human Movement study, while **biomechanics** is the study of motion and its causes in living things.

WHY STUDY BIOMECHANICS?

Scientists from many different areas (e.g. kinesiology, engineering, physics, biology, zoology,) are interested in biomechanics. Why are scholars from so many different academic backgrounds interested in animal movement? Biomechanics is interesting because many people marvel at the ability and beauty in animal movement.

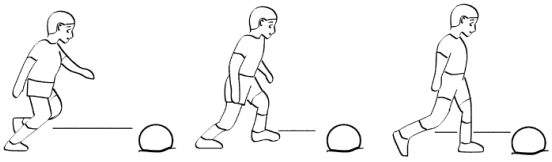
Kinesiology is the scholarly study of human movement, and biomechanics is one of the many academic sub disciplines of kinesiology. Biomechanics in kinesiology involves the precise description of human movement and the study of the causes of human movement. The study of biomechanics is relevant to professional practice in many kinesiology professions.

CRITICAL FEATURES AND TEACHING CUESFOR FAST PLACE KICKING

Critical feature	Possible teaching/ intervention cues
Readiness	Athletic stance
Visual focus	Watch the ball
Intercept	Move and reach towards the ball
Hand position	Thumbs in or thumbs out
Absorption	Give with your hands and arms

QUALITATIVE ANALYSIS OFKICKING TECHNIQUE

The biomechanical principles that are weakly incorporated into the kick are force motion, optimal project ion, inertia, range of motion, coordination, and segmental interaction. Low-trajectory shots are desirable, but this kick, rolling along the ground, will slow the ball down as it rolls, making it easier for opponents to intercept. Finally,



Note the more vigorous approach to the ball. The intensity (inertia) of this approach isapparent in the length of the hurdle to the plant leg and the trunk lean used to maintain balance. It is hard to judge from the figure, but the ball is kicked at the desirable low trajectory shots are desirable, but this kick, rolling along the ground, will slow the ball down as it rolls, making it easier for opponents to intercept. Finally, the student needs considerable. practice to increase the range of motion of the kick and to refine a well-timed sequential coordination that transfers energy through segment lint reactions. One effective intervention strategy would be to provide a cue to plant their foot next to the ball. This is a simple correction that might be related to other weaknesses and might motivate the student with initial success and improvement.

The intensity (inertia) of this approach is apparent in the length of the hurdle to the plant leg and the trunk lean used to maintain balance. It is hard to judge from the figure, but the ball is kicked at the desirable low trajectory. Some educators might conclude that all the biomechanical principles were well applied in this kick.

The only two principles that might be slightly improved are range of motion and coordination. If the student were to approach the ball from a more oblique angle, the rotation of the pelvis on the left hip could be increased (range of motion) and combined (sequential coordination) with the good coordination of the kicking hip and knee.

The application of the principles of Mechanical physics to understand movements and actions of human bodies and sport implements. Kinesiology and biomechanics are intricately related. Principles of these two fields can be applied to the fields of biology, physiology, engineering, Physical and occupational therapy, and medicine as well.

Reasons for Studying Biomechanics Better understanding of the human body and the various internal and external forces that affect movement. Offers scientific knowledge that can improve performance

To improve sport techniques, equipment, and safety To design and conduct programs to enhance individual movement skills (Adapted PE)

Areas of Specialization

- **Developmental biomechanics**

Studies movement patterns and how they change across the lifespan and varying disabilities.

- **Biomechanics of exercise**

To maximize the benefits of exercise and reduce the chances of injury.

- **Rehabilitation mechanics**

Study of the movement patterns of people who are injured or who have a disability.

- **Equipment design**

Increases in performance through the change of equipment.

Major Areas of Study

- Biological aspects underlying human movement Mechanics
- Statics: Study of factors relating to nonmoving systems or those characterized by steady motion.
- Dynamics: Study of mechanical factors that relate to systems in motion
- Kinematics
- Sample Research Questions

How do running motions change as children develop?

How do forces summate to produce maximum power in the tennis serve

How can athletic shoes be designed to reduce injuries on artificial turf?

What is the best body position for swimming the butterfly stroke

Biomechanical Terms

- Velocity

Speed and direction of the body

- Acceleration

Change in velocity involving the speed or direction

- Angular velocity

Angle that is rotated in a given unit of time

- Angular acceleration

Change of angular velocity for a unit of time

- Gravity

Natural force that pulls all objects toward the center of the earth Center of gravity

- Friction

Force that occurs when surfaces come in contact and results from the sliding of one surface on the other Work Force that is applied to a body through a distance and in direction of the force

- Power Amount of work accomplished in one unit of time

- The lower the center of gravity to the base of support, the greater the stability.

- The nearer the center of gravity to the center of the base of support, the more stable the body.

- Stability can be increased by widening the base of support.

Levers

- First class - fulcrum between the weight and the force

- Second class - weight is between the fulcrum and the force

- Third class - force is between the fulcrum and the weight

Mechanical Principle: Force

- The effect that one body has on another.

- Production of Force

Produced by the actions of muscles. The stronger the muscles, the more force the body can produce.

- Application of Force

The force of an object is most effective when it is applied in the direction that the object is to travel.

- Absorption of Force

The impact of a force should be gradually reduced ("give with the force") and spread over a large surface.

ANALYSIS

Quantitative Analysis

Produced through the use of instruments.

Qualitative Analysis (observation suggestions)

Position yourself to see the critical components of the skill. Use multiple vantage points.

Observe performance several times to identify consistent performance problems.

Use the whole-part-whole observation method.

Be sure to focus both on the performer and the implement.

Evaluate the overall effectiveness of the movement.

The Future

- Technology will continue to drive the advancement of knowledge.

- Use of multidisciplinary teams will facilitate integration of data from various sources.

- Increased understanding of human movement will help professionals design solutions to remediate problems for people of all ages and abilities.

- More research on women and the elderly?

Corresponding Author

Dr. Jayaram Maraditot*

Physical Education Director, TMAE Bed College, Ganagavati

E-Mail – jayarammaraditot@gmail.com