

KINESIOLOGY: THE CHALLENGES AND THE WAY FORWARD

By

PETER O. OBOH, Ph.D

*Department of Physical and Health Education,
College of Education Agbor,
Delta State.*

and

TAYIRE FAVOUR OKAGBARE, Ph.D

*Department of Physical and Health Education
Delta State College of Physical Education,
Mosogar.*

Abstract

This paper focused on the challenges encountered by kinesiology and the way forward. Kinesiology is a discipline on its own in sports science. Kinesiology is the study of human movement and breaks a movement down to its components by identifying the muscle used, the sequence employed and endeavour to estimate the extent of their contributions in any given movement .The brief history of kinesiology was highlighted starting from the time of Aristotle. In other to throw much light on the essence of this paper, the following sub-headings were constituted; basic principles of kinesiology, core concept of kinesiology, the challenges of kinesiology, contributions of kinesiology to human sphere as well as the way forward.

Sports science is the systematic application of scientific approach to human movement. Sports science can be referred to as human kinetics and it cannot totally be separated from science because of its application to human and scientific domain. Sports science is also an integral part of the total process of education, since it possess a subject matter essential to human beings, Cohen (2006) as cited by Oboh and Ovuema (2009).

Sports science is a discipline that studies how the healthy human body works during exercise, and how sports and physical activity promote health from cellular to

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whole body perspective (<http://en.wikipedia.org/wiki/sports,science>). The study of sports science traditionally incorporates area of physiology (exercise physiology, psychology (sport psychology), anatomy, biomechanics and bio chemistry (kinesiology). Sports scientists and performance consultants are growing in demand and employment numbers, with the ever increasing focus within the sporting world on achieving the best results possible. Through the study of science sports researchers have developed a greater understanding on how the human body reacts to exercise, training different environments and many other stimuli (http://en.wikipedia.org/wiki//sports_science.)

Kinesiology, also known as human kinetics, is the science of human movement. The term kinesiology is derived from two Greek words – “Kinein” meaning motion and ‘Logos’ meaning knowledge or study of. Therefore, kinesiology means knowledge of motion. It could be defined as the study of human movement or the study of human body as a machine for effective performance. According to Smith (2009) kinesiology is a study which study and breaks a movement down to its components by identifying the muscle used, the sequence employed and endeavour to estimate the extent of their contribution in any given movement. The concept of kinesiology has been broadened to include mechanical municipal, which apply to the movement of the body itself, but also to the movement of implements – balls, javelin and other equipment used in sports. The way we handle these implements determine our successes in the various sports. Consequently, the mechanical aspects of kinesiology deals with such factors as force, friction, elasticity, projectiles and angles (Adams, 2006).

The development of kinesiology as part of school curriculum has opened up new areas in physical education and sports such as the application of mechanical principles to postural adjustments, to the use of tools and household implements and kinesiology addresses physiological, mechanical, and psychological mechanism. Application of kinesiology to human health include bio-mechanics and orthopedics; strength and conditioning; sports psychology methods of rehabilitation, such as physical and occupational therapy and sports and exercise (Ontario Kinesiology Association, 2009).

Kinesiology as a subject discipline in human science cannot be said to be free from its own challenges, just like any other discipline in academic domain. Challenges in kinesiology are impediments that impedes the progress of its success and they are numerous as far as teaching, learning and practices of kinesiology is concerned. These numerous challenges and the way forward is what this paper seeks to address.

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Brief History of Kinesiology

The history of this science goes back to its' definitional beginning. Kinesiology is the combination of the Greek for "to move" (kinein) and 'logos' (discourse). Kinesiology – those who discourse on movement in effect combine anatomy, the science of structure of the body, with physiology, the science of function of the body, to produce kinesiology, the science of movement of the body.

1. It is usually accepted that Aristotle (384 – 322 BC) is the "Father of kinesiology". His treatises, "parts of animal, movement of animals and progression of animals" described the actions of the muscles and subjected them to geometric analysis for the first time. He first analyzed and described walking, in which rotatory motion is transformed into translator motion. Further, he discussed that the motions of pushing a boat under various condition was, in essence, a precursors of Newton's three laws of motion.
2. Archimedes (287 – 212 BC), another Greek, determined hydrostatic principles governing floating bodies that are still accepted as swimming. In addition, his laws of leverage and determining the center of gravity and foundation of the oretical mechanics was accepted.
3. Galen (131 – 201 AD), a Roman citizen who tended the pergamum's glachators in Asia Minor and is considered to have been the first team physician in history. He used number to describe muscles. His essay DE MOTU MUSCULORUM distinguished between motor and sensory nerves, against and antagonist muscles, described tonus, and introduced terms such as diarthrosis and synarthrosis. He taught that muscular contraction resulted from the passage of "animal sports" from the brain through the nerves to the muscles. Some writers considers him the father of sports medicine.
4. In the 15th century, Leoardo da Vinti (1452 – 1519), used letter to identify muscles and nerves in the human body that he retrieved from grave yard in the middle of the night. He described the mechanics of the body standing, walking up and downhill, rising from a sitting position, jumping, and human gait. To demonstrate the progressive action and interaction of various muscles during movement, he suggested that cords be attached to a skeleton at the point of origin and insertion of the muscle.
5. Galileo, the father of parabolic mathematics, also proved that the flight (trajectory) of the projectile through a non-resident medium as a parabola. His work give

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impetus to the study of mechanical events in mathematical terms, which in turn provided a basis for the emergence of kinesiology as a science.

6. The Italian Jesuit Francesco Maria Grimaldi was the first to report hearing sounds made by contracting muscles. Although his book, *physicoma theis de Itlmine*, was published in 1663, 2 years after his death, techniques for studying these sounds were not available until 300 years later.
7. Niels Stenson (1648 – 1686), made the then sensational declaration that the heart was merely a muscle, not a set of “natural warmth” nor of “vital spirit”. He lay the foundation of muscular mechanics.
8. Isaac Newton (1642 – 1727), propounded the law of motion.
9. James Keill (1674 – 1719), calculated the number of fibers in certain muscles assumed that on contraction each fiber become spherical and this shortened.
9. Ranvier L, about 1880, discussed the difference in the spreads of contraction of red and white muscle.

Source: Math --- [http://www.camre.oc.uk/learning /530/ Biomechanics %2011%20DipHE%20year202htm—2005index](http://www.camre.oc.uk/learning/530/Biomechanics%2011%20DipHE%20year202htm—2005index)

Basic Principles of Kinesiology

The basic principles of kinesiology are the guiding terms and terminologies that are useful in understanding the subject domain.

- **Kinematics:** Kinematics is motion of the body without regards to forces.
- **Translation:** When all parts of a 'body' move in the same direction
 - Rectilinear motion (straight line).
 - Curvilinear motion (curved line).
- Rotation (movement of body about an axis)
 - “Pivot point” the axis of rotation that the movement occurs about.
- **Active movements** i.e., flexing on arm over the head.
- **Passive movements** i.e., resistance of a stretched ligament.

Kinesiology Terminology: Anterior: Toward the front of the body. **Posterior:** toward the back of the body. **Midline:** an imaginary line that courses vertically through the

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center of the body. Medial: towards the midline of the body. Superior: above, or toward the head. Inferior: below or towards the feet. Proximal: closer to, or towards the torso. Distal: away from the torso. Cephalad: toward the head. Caudal: toward the feet or “tail”. Superficial: towards the surface (skin) of the body. Deep: toward the inside (core) of the body. Origin: the proximal attachment of a muscle or ligament. Insertion: the distal attachment of a muscle or ligament. Prone: describes the position of an individual lying face down. Supine: describes the position of an individual lying face up.

- **Osteokinematics:** Osteokinematics describes the motion of bones relation to the three cardinal planes. Planes of motion; sagittal plane: left right division. Frontal plane: front-back division. Horizontal plane: top bottom division. Anatomic position: standing starting position. Flexion: motion of one bone approaching the flexor surface of another. Extension: an approximation of the extensor surface of two bones. Abduction: frontal plane movement away from the midline. Adduction: frontal plane movement toward the midline. Radial deviation; lateral hand movement towards the radius. Ulnar deviation: medial hand movement toward the ulna. Dorsiflexion: sagittal plane ankle motion bringing the foot upward. Planter flexion: sagittal plane ankle motion pushing the foot downward.
- **Inversion and Eversion:** Frontal plane motions of the ankle /foot complex. Inversion results in a medial – facing foot sole. Eversion results in a lateral – facing foot sole. Two perspectives of movement at a joint- Open – chain motion – movement of distal segment of bone about a relatively fixed proximal segment, i.e., bicep curl with weights. Chain close motion; movement of proximal segment of bone about a relatively fixed distal segment, i.e., push ups.

Source: www.slidehere.net/loidham5/module-2-kinesiology-getting-started.

Core Concept of Kinesiology

The core concept of kinesiology are the basis of communication about movement that facilitate the progression from lowly skilled to highly skilled performance.

According to Hudson (1995) the core concept at a glance are as follows:

- Range of motion
- Speed of motion
- Number of segments
- Nature of segments
- Balance
- Coordination
- Compactness

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- Extension of release
- Path of projection
- Spin

1. **Range of Motion:** Range of motion is defined as the distance that a body, a body part or an object moves during a time interval of interest. Usually, a greater range of motion either generates or require a greater force. Too much range of motion may require more force than the mover has available. Not only is range of motion relatively easy to observe, it is relatively easy to alter. A tennis player can increase the backswing in a ground stroke and decrease the backswing in a volley;
2. **Speed of Motion:** When range of motion is continued with time we have speed of motion. That is, if an object, such as a served tennis ball, has a large range of motion over a brief period to time, it is consider to have a fast spread of motion. Alternatively, if an object, such as heavy barbell, has a small range of motion over a longer period of time, it is considered to have a low speed of motion. In general, greater speed either generates or requires greater force. That is, you can adjust the speed-of-motion knob, you can adjust the speed-of-motion knob;
3. **Number of Segments:** Active involvement of a segment is indicated by its range of motion. Minimal range of motion denotes an inactive segment, and moderate or maximal range of motion denotes an active segment. In the case of archery, most of the parts of the body are stationery by intention. Conversely, javelin throwers involve most of their body segments. Typically, a greater number of segments is associated with greater force and complexity. As novices try new movements such throwing, they may “freeze out” certain segments to make the movement more simple (Robertson & Halverson, 1984). With improved skill, more and more segments are incorporated into the movements. For big, strong movers (e.g., professional basketball players) and simple or submaximal movement (e.g., the free throw), it may be possible to use too many segments. Thus, adjusting the number of segments knob up and down may lead to better performance or greater skill;
4. **Nature of Segment:** Each active segment has a basic nature or direction of movements. For example, the arms and legs move forward or backward in running, jumping, bowling and punting. There is movement to the right or left in the basketball hook shot and putting in golf. Finally, there is twisting motion of the whole body in the spins of figure skaters and dancers; twisting in the trunk in throwing and batting. Twisting in the plant leg in soccer – style kicking and

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twisting in the racket arm in top-spin tennis shots. In general, the twisting or long-axis rotations generate the greatest speed;

5. **Balance:** The degree of stability or mobility is referred to here as balance. As a person moves, she or her she can be very stable, very mobile, or somewhere in between. Typically, the greatest stability is achieved by maintaining the line of gravity near the middle of the base of support. Skilled gymnasts are very stable on the balance beam, while novice gymnasts often lose their balance and become mobile as they fall of the beam. A runner would be more mobile than a walker because the walker has periods of stability with both feet on the ground and the runner has periods of flight, the ultimate in mobility. To increase mobility one must either move the line of gravity as golfers do or reduce the base of support as runner do. If accuracy is desired, increasing stability may help;
6. **Coordination:** The manner in which bodily actions are timed and sequenced is known as coordination. In terms of timing, a movement which look jerky or sporadic is considered uncoordinated, and one which looks smooth and graceful is considered coordinated. As for sequencing, skilled movers tends to move body segments in unison or simultaneously in heavy activities such as weight lifting and sequentially from large segments to small ballistic activities like throwing and striking. During skill development in ballistic activities, coordination tends to progress from more simultaneous to more sequential. Conversely, in heavy activities, coordination tends to progress from sequential to more simultaneous (Hudson, 1986).
7. **Compactness:** Often a mover can arrange all or some of the body segments to take up less space or to be more compacts. The advantage of turning the compactness knob is that when the body takes up less space, it increases its speed of motion. This is seen when a gymnast or driver assumes a tuck position as compared to a pike or lay-out position. The tuck position is more compact and faster than a lay-out position. Sections of the body also can be positioned to take up less space. The leg is made more compact when initiating the forward swing in kicking or sprinting. (an extreme cases the leg is made so compact that the heel touches the buttocks). Also, the arm is made more compact when initiating the propulsive phase of striking.
8. **Extension of Release/Contact:** If it is advantageous for a mover to be compact at the beginning of the propulsive phase of a movement, it also is advantageous to be extended or stretched at the end of the propulsive phase. A tennis server has

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moved from the compact, back scratch position to a full stretch at the time of contact with the ball. The advantage of greater extension at contact is that greater speed will be imparted to the ball. (This is due in part to greater leverage and to the larger range of motion which affords more opportunity to build up speed). Therefore, extension at release/contact is of primary importance when an object or a body is being projected and a certain amount of speed is desired;

9. **Path of Projection:** When an object or a body becomes air borne, it stood out in a particular path and then it deviates from that path as gravity pulls it back to earth. The characteristics that determine the path of projection are the angle (usually taken with respect to the horizontal) and the speed or velocity at which the object is projected. By now we should be familiar with the concept of speed, but the angle of initial path of movement may be less familiar. In basket ball we project a ball downward when we dunk, nearly horizontally when we pass, at about 45 degrees when we shoot a field goal is free throw, and straight upward in celebration at the end of a close game.
10. **Spin:** When an object or body is projected, it typically rotates or spins about its centre. The magnitude and point at which the propulsive force was applied dictate the amount of spin. If we do not want much spin, such as when hitting a line drive or pitching a knuckles ball, we must hit the ball at the center or remove one fingers at once. If we hit the ball on its edge or remove our finger from one edge, before the opposite edge, it will create spin. Certain movers including baseball and softball pitchers and tennis and volleyball servers might want to experiment with turning knob.

Challenges in Kinesiology

Kinesiology as a subject discipline is confronted with its own peculiar challenges that in no small measures affects her teaching, learning and research practices around the globe. This paper focused on Nigeria situation with its attending challenges that are as follows:

1. **Non-Professional Body:** The Nigerian situation shows that there is no professional body of kinesiology practitioners. This is probably due to the fact that kinesiology as a discipline is not a common subject of study in most Nigerian university. Exercise physiology that is well established does not have a professional body, much less kinesiology. Kinesiologist are very few in Nigeria, and much people are still grappling with its broad contents and principles and shy away in spite of its importance to sports science and athletic prowess and proficiencies.

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2. **Inadequate Provision of Teaching and Research Facilities:** Kinesiology as a discipline is scientifically inclined and demands special teaching and research gadgets and equipment. These gadgets and equipment are quite expensive and scarce to purchase if available. Special laboratory like that for exercise physiology is compulsory for adequate research practices that involves clinical prognosis. Life size skeletons and synthetic muscles attachments are among what should be readily made available which are not quite expensive like electronic gadgets.
3. **Insufficient Manpower:** Manpower or specialist in kinesiology are insufficient. In most cases, exercise physiological are made to teach kinesiology in our universities because of scarce kinesiologists, and this probably had to do with the few universities in Nigeria that specializes in the discipline. Kinesiologist are not in high demand in Nigeria as compared to the United States and United Kingdom.
4. **Unavailability of Research Funds:** Just like other disciplines in Nigerian universities, research funds or grants are scarce commodities. Researches in kinesiology requires huge fund because of its peculiar nature, and unfortunately most times these funds are either unavailable or diverted by unscrupulous officials. Non-governmental agencies are not interested in funding research projects because of their vested interest.
5. **Inconsistent Power Supply:** Despite frantic support made by previous and present administrations in Nigeria to provide constant power supply, power supply is dwindling from bad to worse. This inconsistent or epileptic power supply had also affect the conducting of laboratory test in kinesiology laboratory. Clinical kinesiologist also work with anatomist medical doctors in research practices. Epileptic power supply affects sensitive gadget and these prompt the use of alternative power supply, which are not recommended for such use. Fluctuation in power supply is another disaster experienced by Nigerians in modern times and this is very dangerous to sensitive gadgets and equipment.
6. **Inconsistent School Calendar:** According to Oboh and Atufe (2011), teaching and experimental researchers in exercise physiology are considerably slowed down to inconsistent school calendar in Nigeria, following strike actions of different union bodies in universities. Experimental research processes that involved human subjects, requiring specific time frame will be greatly affected with closure of schools during strike actions.

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7. **Poor Understanding about Kinesiology:** Kinesiology is very useful in athletic training and in combination with exercise physiology, will assist coaches and sports scientist to diagnose and improved postural, musculoskeletal problems and movement during and after training. In the advance country, kinesiologist are always involved during the planning of athletic training and during medical examination of athletes.

Contributions of Kinesiology to Knowledge

Kinesiology as a discipline in sports science has contributed immensely to knowledge. According to en.wikipedia.org/wiki/kinesiology, the following are the health services of kinesiology:

- **Health Promotion:** Kinesiologists working in the health promotion industry work with individuals to enhance the health, fitness, and well being of the individual. Kinesiologists can be found working in fitness facilities, personal training/corporate wellness facilities and industry.
- **Clinical/Rehabilitation:** Kinesiologists work with individuals with disability conditions to assist in regaining their optimal physical function, they work with individuals in their home, fitness facilities, rehabilitation clinics, and at the worksite. They also work alongside physiotherapists and occupational therapists.
- **Ergonomics:** Kinesiologists work in industry to assess suitability of design of work stations and provide suggestions for modifications and assistive devices.
- **Health and Safety:** Kinesiologists are involved in consulting with industry to identify hazards and provide recommendations and solutions to optimize the health and safety of workers.
- **Disability Management/Care Coordination:** Kinesiologists recommend and provide a plan of action to return an injured individual to their optimum function in all aspects of life.
- **Management/Research/Administration/Health and Safety:** Kinesiologist frequently fulfill roles in all above areas, perform research and manage businesses (Canadian Kinesiology Alliance, 2007).

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The Way Forward

The following steps were taken as the way forward:

- Kinesiologists and exercise physiologists should come together to form an alliance through an association, since kinesiologists are very few in this country.
- Departments of sports science should source for funds to establish exercise physiology and kinesiology laboratories. The combined laboratories could be jointly utilized with little modifications for kinesiology gadgets.
- Foreign assistance from concerned universities should be sourced for to enable for financial, manpower and equipment supply.
- Efforts should be made by both private and public universities to employ the few available kinesiologist in other to reduce brain-drain of professionals.
- There should be effort on part of Nigerian universities with human kinetics departments to encourage their students to specialize in kinesiology at the masters degree level.
- Kinesiology should be majored on as a discipline at the first degree level, as it is done in the United State and other advanced countries.
- Steps should be taken to update our highest institutions libraries with modern kinesiology books.
- Alternative power source should be made available at all time so as to facilitate clinical and practical teaching – learning process of kinesiology in laboratory and classroom settings.
- Availability of research grants will go a long way to encourage research practices in kinesiology, as well as giving scholarship to students to further their postgraduate programme in kinesiology.

Summary and Conclusion

Kinesiology is based on the idea that imbalance in the median system cause changes in muscle response. Muscles testing can be used to access subconscious information about the stresses that are causing problems. Kinesiology is a form of complementary therapy; it uses muscle testing to find out correct spiritual, emotional and physical

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imbalance. The brief history of kinesiology was highlighted which starting from 384 B.C to the present time. The core concept of kinesiology are the basis of communication about movement that facilitate the progression from lowly skilled to highly skilled performance. The contributions of kinesiology to human sphere and its challenges were addressed. Without the contributions of kinesiology to knowledge, challenges would not hold water.

Challenges are tall pillar post if properly surmounted will bring about useful and competent objectives in any human endeavour. Surmounted challenges will assist in the classroom settings, but also in its contributions to sports in all its ramifications. The way forward if well implemented will open a leeway towards the advancement of kinesiology and indirectly contributes to the teaching and coaching process. Kinesiology in combination with exercise physiology and biomechanics will take sports to the highest level.

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