

Unit 4: Biomechanics for Sport

Unit code: M/601/1864

QCF level: 5

Credit value: 15

- **Aim**

The aim of this unit is to develop learners' understanding of biomechanical principles and techniques used to improve an individual's or a team's sport performance.

- **Unit abstract**

Think about how many times you have seen David Beckham curl a football around a wall and wondered just how he manages to do it, or when Usain Bolt broke the world record in 100m and you wondered just how he managed to run that fast. These phenomena of truly expert performance in sport can be partially explained through the use of sports biomechanics.

Sports biomechanics is the branch of sport and exercise sciences that examines the causes and consequences of human movement and the interaction of the body with apparatus or equipment through the application of mechanical principles in sporting settings. It is one of the key areas to understand when analysing the performance of both individuals and teams.

This unit combines theoretical and applied learning contexts allowing learners to examine traditional principles of biomechanics through a practical learning environment. Learners will also discover how to use essential practical techniques in sports biomechanics through investigating different sporting activities first hand, which will give learners a greater understanding of the key mechanical principles in sport performance. Learners will start to adopt an evidence-based practice approach to their work which will help them to prepare for possible careers within sport and exercise sciences, sports therapy and other related areas.

The knowledge and skills gained through this unit will be useful for learners wishing to progress into careers based around performance analysis, sports injury, sports therapy, sports coaching and fitness instructing or training.

- **Learning outcomes**

On successful completion of this unit a learner will:

- 1 Understand biomechanical principles in sporting contexts
- 2 Be able to record sport performances using biomechanical techniques
- 3 Be able to conduct notational analyses of performance
- 4 Be able to compare sport performances to biomechanical models.

Unit content

1 Understand biomechanical principles in sporting contexts

Biomechanical principles: planes and axes of motion; kinematics (definition, linear kinematics, rotational kinematics, projectile motion); kinetics (definition, linear kinetics, rotational kinetics, friction, impact); fluid mechanics (viscosity, fluid kinematics, types of flow, drag forces, lift forces, Bernoulli principle and Magnus effect)

2 Be able to record sport performances using biomechanical techniques

Recording sport and exercise performance: planning skills eg participant preparation, equipment preparation; recording techniques eg digital photography, video recording, two dimensional and three dimensional recording; recording principles eg frame rate, horizontal scaling, vertical referencing, perspective error, validity, reliability, accuracy, precision; following guidelines for recording techniques and recording principles

3 Be able to conduct notational analyses of performance

Notational analysis: background to manual notation systems; background to electronic notation programmes eg Gamebreaker; sport specific performance criteria; data collection; data analysis; displaying data

Providing feedback: use of appropriate language for athletes and coaches; providing recommendations for future performance; using literature to support recommendations for future performance; target setting

4 Be able to compare sport performances to biomechanical models

Biomechanical models: literature-based and elite athlete-based numerical models; literature-based and elite athlete-based technical models; combination of literature-based and elite athlete-based models

Comparing performance to models: identifying strengths and areas for improvement of performance, using literature to support identified strengths and areas for improvement

Providing feedback: use of appropriate language for participants and coaches; providing recommendations for future performance; using literature to support recommendations for future performance; target setting

Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand biomechanical principles in sporting contexts	1.1 discuss the planes and axes of motion 1.2 discuss kinetic principles in sporting contexts 1.3 discuss kinematic principles in sporting contexts 1.4 explain fluid mechanics in sporting contexts
LO2 Be able to record sport performances using biomechanical techniques	2.1 plan a data collection session to record performance 2.2 justify techniques used within the recording session 2.3 record a performance using biomechanical recording techniques
LO3 Be able to conduct notational analyses of performance	3.1 explain manual notation systems and electronic notation systems 3.2 justify performance criteria to be used as part of the notational analysis 3.3 carry out a notational analysis of a sport performance of a selected individual or team 3.4 produce feedback for an individual or team based on the notational analysis, providing recommendations on how to improve future performance
LO4 Be able to compare sport performances to biomechanical models	4.1 select and justify the selection of a biomechanical model for a chosen sport performance 4.2 compare an observed sport performance to the selected biomechanical model 4.3 provide feedback for the participant in the observed performance to improve performance 4.4 justify the performance recommendations given in feedback

Guidance

Links

This unit has links to the following units in the BTEC Higher Nationals in Sport and in Sport and Exercise Sciences:

- *Unit 3: Research Methods for Sport and Exercise Sciences*
- *Unit 5: Research Project*
- *Unit 8: Field-based Fitness Testing for Sport and Exercise Science*
- *Unit 9: Principles of Sports Coaching*
- *Unit 10: Applied Sports Coaching*
- *Unit 19: Laboratory and Experimental Methods in Sport and Exercise Sciences*
- *Unit 28: Sports Coaching.*

Essential requirements

Learners will need access to video and digital photography equipment to be able to complete the practical elements of the unit. Centres would benefit from having access to specific performance and movement analysis software (such as *Gamebreaker* or *Dartfish*) and equipment such as, a force plate, an electromyogram and 2D/3D video recording and analysis equipment (such as *Qualisys*).

Employer engagement and vocational contexts

Learners would benefit from visits and guest speaking from sports biomechanists, performance analysts and sports therapists.