

EXERCISE AND SPORTS SCIENCE

SYLLABUS

Upper Secondary

Express Course

Normal (Academic) Course

Implementation starting with
2018 Secondary Three Cohort



Ministry of Education
SINGAPORE

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CONTENTS

	Page
1. INTRODUCTION	
• Purpose	3
• Curriculum Concept and Syllabus Aims	3
• Developing 21CC	8
2. LEARNING CONTENT	
• Scope & Sequence	12
• Learning Outcomes	14
3. PEDAGOGY	
• How will students learn in Exercise and Sports Science?	29
• What is the role of the teacher in Exercise and Sports Science?	29
4. ASSESSMENT	
• Our assessment philosophy	32
• The national examination	32

1. INTRODUCTION

PURPOSE

Exercise and Sports Science (ESS) is an interdisciplinary subject where students will be grounded in the sub-disciplines of sports science with an understanding of sociology in relation to sports. Through the study of ESS, students will develop disciplinary thinking and practices of the subject and thus *interdisciplinary understanding*.

What is interdisciplinary understanding?

Interdisciplinary understanding is the capacity to integrate knowledge and modes of thinking drawn from two or more disciplines to produce a cognitive advancement—for example, explaining a phenomenon, solving a problem, creating a product, or raising a new question—in ways that would have been unlikely through single disciplinary means¹.

ESS would thus develop students' *interdisciplinary understanding* to problem-solve and evaluate performance for improvement in different practical settings as well as adopt a balanced view in examining issues influencing sport and participation in physical exercise.

CURRICULUM CONCEPT AND SYLLABUS AIMS

In ESS, **movement** is the focal point for performance, analysis and critique. ESS students will understand the relationships amongst the sub-disciplines of sports science and how **systems** within these sub-disciplines **interact** to influence how the human body moves in relation to each other and in different contexts. Movement contexts exist in specific exercises and sports, which in turn, manifest themselves in why and how people exercise and participate in sports in society, as influenced by socio-cultural factors such as commercialisation, ethics and equity.

¹ Mansilla, V. B. (2005). Assessing student work at disciplinary crossroads. *Change: The Magazine of Higher Learning*, 37(1), 14-21.

Big Ideas in Exercise and Sports Science

Movement. The sub-disciplines of sports science are inter-related and influence how the human body moves in different contexts. A multi-faceted perspective is needed to analyse performance holistically and modify movement for improvement. Socio-cultural factors have an influence on people moving, exercising and staying active, thus shaping the movement culture of a society.

Systems and interactions. The human body is a complex system of many interacting parts and the various systems in the human body interact with each other to create movement. Adopting a holistic lens for performance analysis, it is of essence to be cognisant of the role of each sub-discipline of sports science and how they interact with each other within a system to influence movement. A society is a system of inter-related parts and is greatly shaped by the interaction of the socio-cultural factors of commercialism, ethics and equity. It is the interaction of these factors that would continue to shape how people move, exercise and participate in physical activities.

Why Big ideas in Exercise and Sports Science?

ESS students acquire deep understanding as the learning content is focused on teaching for meaning and understanding of 'big ideas', rather than on discrete facts and procedures². Meaning and understanding can thus be constructed when ESS students work with a rich theoretical base that is not simply a large set of disconnected facts, but rather, a set of facts and ideas within the context of a conceptual framework. **Big ideas** thus frame and shape ESS students' understanding of new information, and allow them to construct this information into usable knowledge within this framework. Such conceptual understanding will later also help ESS students select and remember relevant information and to eventually become expert learners³ hence transferring their learning to new situations.

² McTighe, J., Seif, E., & Wiggins, G. (2004). You can teach for meaning. *Educational Leadership*, 62(1), 26-31.

³ Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school*. National Academy Press.

As ESS students make sense of their acquired knowledge in the areas of study, they apply their learning in the performance and analysis of movement within the practical activities; and in the critique of issues in physical exercise and sports from socio-cultural and global perspectives. These reinforce students' learning and thus deepen their understanding of the acquired knowledge and skills in the respective areas of study.

The syllabus content consists of five areas of study: exercise physiology, biomechanics, sports psychology, sports sociology and, motor learning and development. The curriculum concept for ESS is diagrammatically illustrated in **Figure 1**.

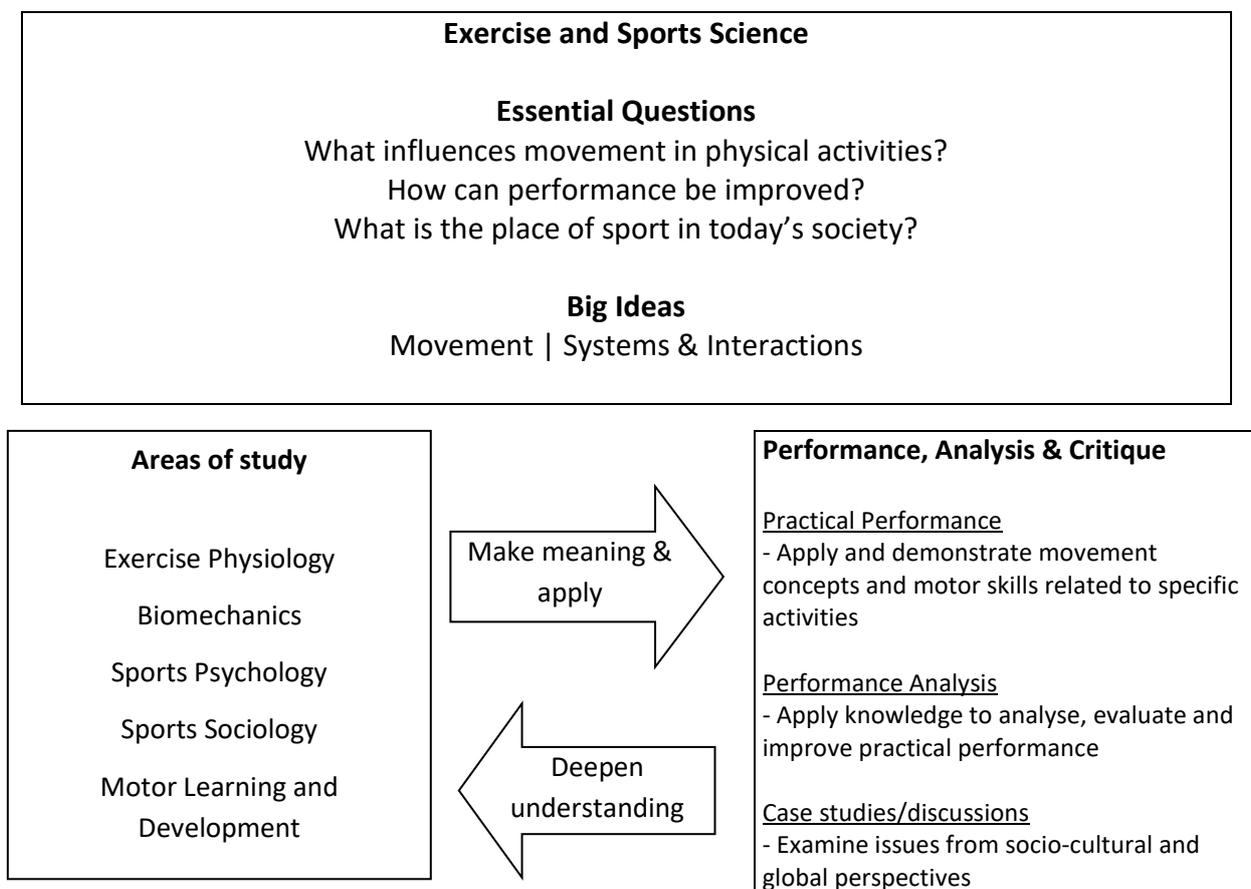


Figure 1: O-Level Exercise and Sports Science Curriculum Concept

Aims of the Syllabus

The aims of the syllabus are for students to:

- Acquire and apply the knowledge in exercise physiology, biomechanics, and sports psychology to analyse, evaluate and improve practical performances in physical exercises and sports;

- b. Develop the movement concepts and motor skills to be proficient in the performance of a team and an individual / dual⁴ sport;
- c. Understand the benefits and risks associated with physical exercise and sports to manage personal participation in physical activities; and
- d. Examine issues related to sports and participation in physical activities from socio-cultural and global perspectives.

Key Understandings

The syllabus intends to develop students in understanding that:

- a. The sub-disciplines of sports science are inter-related and will influence how the human body moves in different contexts;
- b. A multi-faceted perspective is needed to analyse performance holistically for improvement; and
- c. Socio-cultural factors have an influence on people moving, exercising and staying active.

Knowledge

The syllabus intends for students to know:

- a. The various systems in exercise physiology such as skeletal system, muscular system, circulatory system, respiratory system and; nutrition;
- b. How natural laws and forces affect the body in sports movement and performance in the area of biomechanics;
- c. The concepts of self-efficacy, factors affecting anxiety and stress; motivation and; exercise psychology in the area of sports psychology;
- d. Issues pertaining to commercialisation, ethics and equity in sports in the area of sports sociology; and
- e. Factors influencing motor learning and development; as well as movement and game concepts.

⁴ Dual sports activities refer to sports that one can do with a partner such as badminton, tennis and fencing. (Corbin & Lindsey, 2014).

Skills

The syllabus intends for students to:

- a. Analyse, evaluate and improve practical performance in practical activities;
- b. Apply theoretical application to create a self-improvement plan;
- c. Examine critically issues related to sports and participation in physical activity from socio-cultural and global perspectives;
- d. Communicate ideas and beliefs while discussing issues regarding commercialisation, ethics and equity in sports; and
- e. Develop game-related and movement concepts; and motor skills.

Desired Student Outcomes

The ESS student is knowledgeable in the sub-disciplines of sports science and be able to adopt an inter-disciplinary approach to problem-solve practical situations related to exercise and sports. Through the study of the subject, he/she develops the analytical skills to observe, analyse and evaluate practical performance for improvement.

The ESS student deepens his/her understanding of the factors influencing exercise and sports and develop greater sensitivity and a critical perspective when looking at issues related to sports in Singapore and the world, while living out the ideals of a physically active and healthy lifestyle.

The ESS student will have a strong foundation to continue in areas of studies directly related to exercise, sports, health and wellness at post-secondary education institutes. Given the training in applying critical and inventive thinking, self-discipline to apply knowledge and skills to improve personal performance, and managing projects and deadlines, the ESS student will also be well-prepared to pursue other fields beyond exercise and sports in the junior colleges/centralised institutes at the post-secondary level.

DEVELOPING 21CC

Globalisation, changing demographics and technological advancements are some of the key driving forces of the future. Our students will have to be prepared to face these challenges and seize the opportunities brought about by these forces.

To help our students thrive in a fast-changing world, MOE has identified three competencies that have become more important than ever in the globalised world of the 21st Century. They are **Civic Literacy, Global Awareness and Cross-Cultural Skills; Critical and Inventive Thinking;** and **Communication, Collaboration and Information Skills**. They enable students to tap into rich opportunities in the emerging digital age. The framework showing the 21st Century Competencies (21CC) and Student Outcomes is shown in **Figure 2** below.

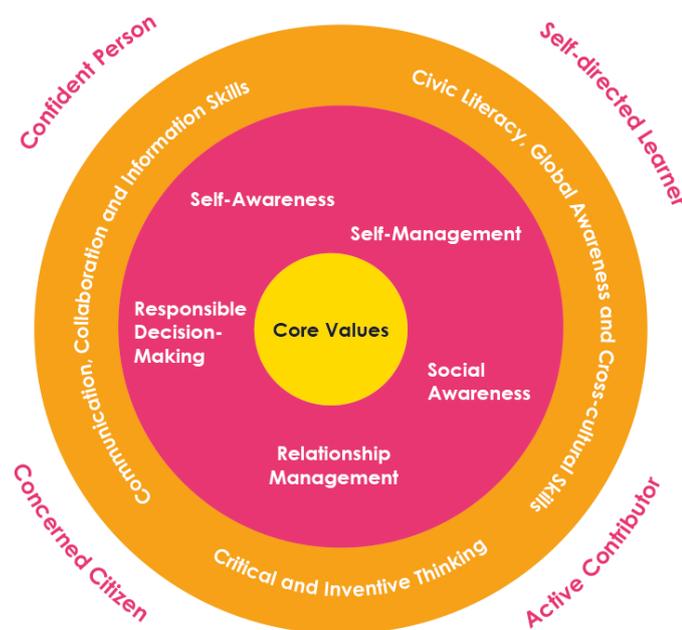


Figure 2: Framework for 21st Century Competencies and Student Outcomes

Knowledge and skills must be underpinned by values. Values define a person's character. They shape the beliefs, attitudes and actions of a person, and therefore form the core of the framework of 21st Century Competencies. The middle ring signifies the Social and Emotional Competencies – skills necessary for children to recognise and manage their emotions, develop care and concern for others, make responsible decisions, establish positive relationships, as well as handle challenging situations effectively. The outer ring of the

framework represents the 21CC and together these competencies will enable our young to tap into the rich opportunities in the new digital age, while keeping a strong Singapore heartbeat.

ESS affords a plethora of opportunities for students to develop their 21CC especially in the domains of **Critical and Inventive Thinking**; and **Communication, Collaboration and Information Skills**. Through seeing the linkages between areas of study and understanding the relevance, students will be able to use sound reasoning and decision-making in applying the knowledge to the physical activities. Interesting subject matter and the integration of the learning will not only pique their curiosity but enhance their creativity. Students will also learn to manage uncertainty and adapt to diverse demands and challenges in various unfamiliar situations, especially during the practical activities. The theoretical knowledge and practical activities would provide an environment suitable to stimulate their Critical and Inventive Thinking.

ESS students would learn to communicate their ideas effectively in discussions for the respective areas of study. They will learn to be open and appreciative of views that are diverse and differing to their own. Students will also reflect on the role they play in a group, and uses information and ideas developed collectively with others to create new information and/or solutions. Communication, Collaboration and Information Skills would therefore be fostered.

Developing 21CC would hence be embedded within the subject of ESS. The authentic contexts that students are put in would be ideal for them to enhance the domains of 21CC and the teachers that teach the subject would be play a vital role in the delivery of the competencies which are layered over the psychomotor and cognitive learning outcomes.

Table 1 below illustrates how the O-Level ESS curriculum is aligned with the Standards and Benchmarks for 21CC.

O-Level Exercise and Sports Science Knowledge, Skills & Values	Standards and Benchmarks for Emerging 21CC by End of S4/S5
Acquire and apply the knowledge in exercise physiology, biomechanics, and sports psychology to analyse, evaluate and improve practical performances in physical exercises and sports.	Critical and Inventive Thinking (CIT)
	<p>CIT 1: Explores possibilities and generates ideas</p> <p>CIT 1.1d: The student is able to generate ideas and explore different pathways that lead to solutions.</p>
Understand the benefits and risks associated with physical exercise and sports to manage personal participation in physical activities.	Critical and Inventive Thinking (CIT)
Examine issues related to sports and participation in physical activities from socio-cultural and global perspectives.	CIT 2: Exercises sound reasoning, decision-making and metacognition.
	CIT 2.1d: The student is able to use evidence and adopt different viewpoints to explain his/her reasoning and decisions, having considered the implications of the relationship among different viewpoints.
Apply theoretical application to create a self-improvement plan.	Critical and Inventive Thinking (CIT)
	CIT 1: Explores possibilities and generates ideas

O-Level Exercise and Sports Science Knowledge, Skills & Values	Standards and Benchmarks for Emerging 21CC by End of S4/S5
	CIT 1.1d: The student is able to generate ideas and explore different pathways that lead to solutions.
Communicate ideas and beliefs while discussing issues regarding commercialisation, ethics and equity in sports.	Communication, Collaboration and Information Skills (CCI)
	CCI 1: Communicates and collaborates effectively CCI 1.1d: The student is able to convey complex information and ideas coherently and clearly to create impact for specific purposes and contexts.
	CCI 1.2c: The student is able to interact with others to construct knowledge, and new understanding and ideas.

Table 1: Alignment with Standards and Benchmarks for Emerging 21CC

2. LEARNING CONTENT

SCOPE AND SEQUENCE OF THE SYLLABUS

The general PE curriculum provides a strong foundation for the learning of Exercise and Sports Science (ESS), where students would already be able to demonstrate individually and with others the physical skills, practices, and values to enjoy a lifetime of active, healthy living. This is done by educating students in, through and about movement⁵. ESS will build on the learning from general PE to provide breadth and depth to the study of exercise and sports through the disciplines of exercise physiology, sports psychology, biomechanics and sports sociology.

The syllabus content affords the opportunities for studying the theoretical underpinnings within the disciplines in ESS and applying them in practice to understand, analyse and appreciate human movement. The practical activities, performance task and case studies would provide the authentic contexts for integrating conceptual learning and real-life experiences for *flexible understanding*⁶ of knowledge application.

What are Key Understandings and Essential Questions?

Each area of study is undergirded by **Key Understandings** (KUs) which frame the teaching and learning of key concepts while highlighting the connections between them.

Essential Questions (EQs) are distilled from the KUs and are doorways to students developing the KUs while serving as triggers to facilitate the process in the teaching and learning of the respective area of study.

⁵ Adapted from Arnold, P. J. (1979). *Meaning in movement, sport and physical education*. London: Heinemann.

⁶ Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school*. National Academy Press.

Acquisition of knowledge and skills

For ESS students to construct meaning (i.e. to come to an understanding) of important ideas and processes, they would need to acquire factual information and basic skills as delineated in the segment of ***knowledge and skills*** for each area of study.

The **Learning Outcomes (LOs)** specify minimally what ESS students should know and be able to do for each area of study. They serve to guide the development of unit and lesson planning, and the conduct of the lesson.

LEARNING OUTCOMES

Exercise Physiology

Overview of Area of Study	
<p><u>Exercise Physiology</u> helps students understand the physiological factors affecting health, fitness and performance. Students study the relationship between the human body and movement, as well as how energy systems and sports nutrition have an impact on their performance in practical activities.</p>	
Key Understandings	Essential Questions
<p><i>Students will understand that:</i></p> <p>The skeletal, muscular, circulatory and respiratory systems interact to influence movement and performance in physical activities.</p> <p>Sports nutrition is integral to optimising performance in physical activities.</p>	<p>How can physiology influence movement and performance in physical activities?</p>
Knowledge	Skills
<p><i>Students will know:</i></p> <ol style="list-style-type: none"> the major bones and joints in the body and their functions; the characteristics of muscles, how they are classified and the roles of the major muscle groups; the components and functions of the circulatory system; the components and functions of the respiratory system; and the different components of food and their effects on sporting performance. 	<p><i>Students will be able to:</i></p> <ol style="list-style-type: none"> improve performance and manage injuries through analysis of joint movement; identify the different muscles used in various sports and improve muscular system, and thereby sporting performance; analyse the requirements of the circulatory and respiratory systems in physical activities; and evaluate the nutritional requirements before, during and after a physical activity.

Learning Outcomes

Students will be able to:

Skeletal System

- Explain the functions of the skeleton and functions of the major bones
 - skull
 - clavicle
 - sternum
 - scapula
 - humerus
 - radius and ulna
 - phalanges
 - carpals and metacarpals
 - vertebrae
 - femur
 - tibia and fibula
 - tarsals and metatarsals

- Describe the roles and functions of the different joints
 - immovable joints
 - slightly movable joints
 - freely movable joints

- Describe the different types of joint movement
 - flexion
 - extension
 - rotation
 - abduction
 - adduction
 - circumduction

- Explain the characteristics of freely movable joints
 - ball and socket
 - hinge
 - gliding
 - pivot

- Describe the roles and functions of connective tissue
 - ligaments
 - tendons
 - cartilage

- Describe the injuries at joints; and their associated causes and preventive measures
 - overuse injuries
 - incorrect movement injuries
 - impact or twisting injuries

Muscular System

- Recognise the types and characteristics of muscles
 - visceral (“smooth”) muscles
 - cardiac muscles
 - skeletal muscles

- Identify the major muscle groups
 - trapezius
 - latissimus dorsi
 - pectoralis major
 - deltoids
 - biceps brachii
 - triceps brachii
 - abdominals
 - obliques
 - gluteus maximus
 - quadriceps
 - hamstrings
 - gastrocnemius

- Show an understanding of muscle action and control
 - origin, insertion and belly
 - agonist, antagonist and synergist muscles
 - concentric, eccentric, isometric action

- Explain the relevance of the identified muscle groups in physical activities and sporting performance
 - main muscle groups
 - core muscles
 - stabilizer muscles
- Explain the role and function of tendons during movement.

Circulatory System

- Identify the components and show an understanding of the functions of circulatory system
 - blood vessels
 - heart
 - blood
- Identify the components of blood and show an understanding of the functions of the components
 - plasma
 - red blood cells
 - white blood cells
 - platelets
- Explain the short and long term effects of exercise on circulatory system.

Respiratory System

- Identify the components and show an understanding of the functions of respiratory system
 - nose/mouth
 - trachea
 - bronchus
 - bronchioles
 - alveoli
 - lungs
- Describe the different energy systems and explain how they contribute to sporting performance
 - anaerobic systems (creatine phosphate and lactic acid systems)
 - aerobic system

- Explain the effects of exercise on aerobic and anaerobic systems.

Training Principles and Methods

- Explain and apply the principles of Frequency, Intensity, Time and Type (FITT) and Specificity, Progression, Overload, Reversibility and Individuality (SPORI) in the development of a suitable training programme with an understanding of the components of fitness.
- Explain and apply the methods of circuit training, continuous training, cross training, fartlek training, interval training, weight training and altitude training in developing a suitable training programme.

Nutrition

- Explain the effects of nutritional components on the body
 - carbohydrates
 - fats
 - proteins
 - vitamins
 - minerals
 - fibre
 - water
- Explain the concept of energy balance
 - basal metabolic rate
 - energy equation
 - energy for activities
- Recognise the nutrition for different phases of activity
 - pre-activity
 - during activity
 - post-activity
- Explain the importance of fluid replacement on the body.

Biomechanics

Overview of Area of Study	
<p><u>Biomechanics</u> is the study of how natural laws and forces affect the body in sports movement and performances. Through this area of study, ESS students would understand the mechanical cause-effect relationships that determine human movement and the biomechanical principles to refine and improve movement. In ESS, students would apply biomechanical principles to improve and refine movement. They use practical activities to demonstrate biomechanical principles and how the correct application of biomechanics can lead to improved performance in sport and physical activity.</p>	
Key Understandings	Essential Questions
<p><i>Students will understand that:</i></p> <p>Force and motion; summation of forces and projectile motion are important in the learning and performance of physical activities.</p> <p>The proper application of biomechanical principles will lead to improved and refined human movement.</p>	<p>How can efficient movement be achieved?</p> <p>How can movement be improved and refined?</p>
Knowledge	Skills
<p><i>Students will know:</i></p> <ol style="list-style-type: none"> a. the effect of the natural laws and forces on the human body in sports movement and performances; b. the biomechanical principles such as force, centre of gravity, summation of forces and projectile motion; and c. the phases (during preparation, action and follow through) of performances for analysis. 	<p><i>Students will be able to:</i></p> <ol style="list-style-type: none"> a. Observe and evaluate efficiency of movement accurately; and b. Apply biomechanical principles such as force, centre of gravity, summation of forces and projectile motion to analyse movement for refinement and improvement.

Learning Outcomes

Students will be able to:

- State Newton's Laws of motion
 - Law 1: *"All bodies continue in a state of rest or uniform motion in a straight line unless acted upon by some external force."*
 - Law 2: *"The acceleration of a body is proportional to the force causing it and takes place in the direction the force acts."*
 - Law 3: *"To every action there is an equal and opposite reaction."*
- Explain the effect of the following on biomechanical movement in sports and physical activities
 - force
 - centre of gravity
 - stability
 - mass and weight
 - acceleration
- Know the different classes of levers in the human body and their application in sports and physical activities.
- Explain how summation of forces⁷ can be applied to performances in sports and physical activities.
- Describe how projectile motion can influence performance
 - including the human body as a projectile;
 - the Magnus effect and spin (back spin, top spin, side spin)
 - height of release, angle of release, velocity of release
 - flight path (trajectory)
- Recognise the phases (during preparation, action and follow through) of performance and use a biomechanical analysis to analyse physical performances.
- Apply concepts in biomechanics to modify physical performance responses for improvement.

⁷ Summation of forces refers to the sum of all forces generated by each body part. Force summation also requires all body parts to move in sequence (largest muscles to smallest) for maximum force to be generated.

Sports Psychology

Overview of Area of Study	
<p><u>Sports Psychology</u> involves the study of how psychological factors affect performance. It also explores how participation in sport and exercise affect psychological and physical factors and vice versa. Through this, students are not only able to motivate themselves to participate in physical exercise, but also encourage others to do the same. They will understand how mental preparation for performance can be just as critical as physical preparation.</p>	
Key Understandings	Essential Questions
<p><i>Students will understand that:</i></p> <p>Psychological factors (self-efficacy, anxiety and motivation) can affect performance and participation in sports and physical activities.</p> <p>Mental preparation is as equally important as physical preparation for movement and performance in sports and physical activities.</p>	<p>How can psychology influence movement and performance in sports and physical activities?</p> <p>How does mental preparation influence movement and performance in sports and physical activities?</p>
Knowledge	Skills
<p><i>Students will know:</i></p> <ol style="list-style-type: none"> a. the concept of self-efficacy, the sources of self-efficacy and its relation to sports performance; b. the factors affecting anxiety and coping strategies for stress; c. the relation of extrinsic and intrinsic motivation to sports performance; and d. the factors influencing exercise participation. 	<p><i>Students will be able to:</i></p> <ol style="list-style-type: none"> a. use different mental strategies to improve performance in a physical activity; and b. analyse the psychological factors of exercise participation.

Learning Outcomes

Students will be able to:

Self-Efficacy

- Define and know what is self-efficacy and the factors influencing self-efficacy
 - performance accomplishments
 - vicarious experience
 - verbal persuasion
 - physiological state
- Explain the concept of self-efficacy in relation to performance in sports and physical activities as well as how self-efficacy can affect performance.

Motivation

- Define what is motivation and the types of motivation; intrinsic and extrinsic.
- Explain the factors affecting the types of motivation and how motivation will influence performance
 - Intrinsic motivation
 - personal achievement
 - sense of competency
 - perceived control
 - self-confidence
 - positive self-regard
 - Extrinsic motivation
 - social approval
 - material rewards
 - social status

Arousal and Performance

- Recognise the physiological responses of the body to arousal
 - production of adrenaline
 - increased heart rate
 - increased respiration
 - muscles tense in readiness for action
- Know and explain the relationship between arousal and performance
 - inverted U Theory (Yerkes-Dodson Theory)
 - causes of over-arousal (Over stimulation and anxiety)

Anxiety

- Explain how personal and situational factors affects anxiety
 - Personal factors affecting anxiety
 - expectations
 - cognitive appraisal
 - coping style
 - perfectionism
 - fear of failure/success
 - low self-confidence
 - Situational factors affecting anxiety
 - competition
 - pressure
 - planning
- Explain the effects of anxiety on performance as well as the coping strategies (goal setting, relaxation, visualization, and mental rehearsal) in managing anxiety.

Factors influencing exercise participation

- Explain the influence of self-efficacy and motivation on exercise participation as well as the effect of exercise on psychological well-being.

Sports Sociology

Overview of Area of Study	
<p><u>Sports Sociology</u> examines how socio-cultural factors influence why and how people exercise and stay active and participate in sports. Sports participation is also examined from a critical and global perspective, particularly in relation to issues such as commercialisation, ethics and equity.</p>	
Key Understandings	Essential Questions
<p><i>Students will understand that:</i></p> <p>Socio-cultural factors (equity, commercialisation and ethical) influence participation in exercise and sports.</p>	<p>What influences participation in exercise and sports?</p>
Knowledge	Skills
<p><i>Students will know:</i></p> <ol style="list-style-type: none"> a. how equity can affect participation in exercise and sports; b. the impact of commercialisation on participation in exercise and sports; and c. the ethical issues prevalent in sports today. 	<p><i>Students will be able to:</i></p> <ol style="list-style-type: none"> a. communicate ideas and beliefs while examining issues regarding equity, commercialisation, and ethics in sports.

Learning Outcomes

Students will be able to:

Equity

- Discuss the factors (i.e. opportunities given, resources available) affecting participation in exercise and sport with regard to
 - gender
 - race
 - disability

Commercialisation

- Discuss the issue of sponsorship in sports
 - advantages and disadvantages of sponsorship in sports
 - advantages and disadvantages of sponsorship from the perspective of a sponsor
- Recognise and discuss the issue of media (social, internet, visual and print) and sport
 - impact of media technology in sport
 - positive and negative effects of media
 - media coverage of female sports

Ethics

- Discuss the issue of drugs in sport
 - Reasons for drug taking
 - Types of drugs (performance enhancing) and their effects
 - stimulants
 - anabolic agents
 - diuretics
 - erythropoietin
 - growth hormones
 - beta blockers
- Recognise and discuss the issue of sportsmanship and gamesmanship in sports
 - definitions of sportsmanship and gamesmanship
 - examples of sportsmanship and gamesmanship

Motor Learning and Development

Overview of Area of Study	
<p><u>Motor learning⁸ and Development⁹</u> involves the study of how motor learning and development affect the performance of an individual in individual/dual sport or group of individuals in a team sport. Through this area of study, ESS students would understand the factors affecting the acquisition of skills. In ESS, students would apply motor learning principles and feedback in the practical activities¹⁰ to improve and refine their motor skills and movement patterns, thus deepening their understanding of movement concepts¹¹ in achieving movement goals.</p>	
Key Understandings	Essential Questions
<p><i>Students will understand that:</i></p> <p>Motor learning and development are influenced by various factors and would impact the performance of motor skills and movement patterns.</p>	<p style="text-align: center;">What influences the development of motor skills and movement patterns?</p>
Knowledge	Skills
<p><i>Students will know:</i></p> <ol style="list-style-type: none"> a. the different classification of skills; b. factors affecting motor learning and development; c. the activity-specific motor skills and movement patterns; and d. the movement concepts involved in the selected practical activities. 	<p><i>Students will be able to:</i></p> <ol style="list-style-type: none"> a. perform the activity-specific motor skills and movement patterns effectively and apply them in different practical activities; and b. combine skills and movement concepts effectively in the context of the selected practical activities.

⁸Motor Learning refers to the relatively permanent gains in motor skill capability associated with practice or experience (Schmidt & Lee, 2005).

⁹Motor development refers to the continuous age-related process of change in movement as well as the interacting constraints (or factors) in the individual, environment, and task that drive these changes (Haywood & Getchell, 2001).

¹⁰Students would be engaged in 2 practical activities chosen from the categories of sports and games.

¹¹Movement concepts are knowledge and understanding of movements that allow individuals to adapt and modify their movements to achieve specific movement goals.

Learning Outcomes

Students will be able to:

- Show an understanding of the Skills Classification (basic & complex, fine & gross, open & closed).
- Explain the factors affecting variations in skill level
 - Motor Development
 - age
 - maturity
 - motivation
 - anxiety
 - arousal conditions
 - facilities and equipment
 - environment
 - Motor Learning
 - teaching and coaching
- Explain differences between the skills of Novice and Expert performer in relation to
 - Information Processing Model
 - input/information Gathering Stage
 - decision- Making Stage
 - output/performance Stage
 - feedback Stage
 - Different types of feedback and their importance
 - knowledge of Performance (KP)
 - knowledge of Results (KR)
 - intrinsic Feedback
 - extrinsic Feedback
- Explain key considerations such as *task complexity, interdependence of parts of task and level of competence*, in design of practice: whole practice, part practice, whole-part-whole practice and progressive part practice, when acquiring a new skill.
- Demonstrate the understanding of movement concepts using the BSER¹² framework through the practical activities.

¹²Body Awareness (what the body is doing), Space Awareness (where the body is moving), Effort (how the body is moving) Relationships (with whom or what the body is relating as it moves).

- Apply the activity-specific movement concepts effectively in different practical activities.
- Show an understanding of the relevant game-related concepts¹³ and apply these concepts in different practical activities.

¹³Reacting and responding to the opponents' play , Identifying situational problems pertinent to the game and creating possible solutions to overcome these problems, Decision-making (how, when & where) pertaining to the tactics / strategies involved in the game.

3. PEDAGOGY

HOW WILL STUDENTS LEARN IN EXERCISE AND SPORTS SCIENCE?

Learning is an active process of constructing knowledge and the educational philosophies and ideas of John Dewey, Lev Vygotsky, Jean Piaget and Jerome Bruner reinforces the notion that children actively construct knowledge in a social context.

Thus, students in Exercise and Sports Science (ESS) will learn through;

Practical activities. Through practical activities, the nexus between the theoretical and the practical is strengthened, as students experience multiple experiences and behaviours through different spaces and environments while applying their knowledge to improve performance. ESS students develop the critical eye to analyse biomechanical movement, understand the inter-relatedness of the different variables influencing the movement of an individual in different environment; and appreciate the performance of an athlete, while applying the knowledge, skills and competencies to improve his/her own physical performance and lifestyle.

Case studies. Using authentic case studies, ESS students acquire a global and critical perspective as they examine social and cultural issues related to sport and society. Through the discussion, students learn to analyse issues from multiple perspectives, present, and justify their own stance while appreciating differing views. Students thus acquire a more balanced and holistic views of the issues examined, and make 'individual sense' of their learning as they work with others and deepen their understanding of the place of sport in today's society.

WHAT IS THE ROLE OF THE TEACHER IN EXERCISE AND SPORTS SCIENCE?

The ESS teachers play a pivotal role in shaping the way students learn the subject. Instructional decisions taken by the teachers and the kind of environments they create greatly influence how and what students learn in ESS.

Learning by Doing

ESS teachers should create learning experiences and provide opportunities for students to be actively involved in using or even testing theories in authentic situations. Students should be involved in hands-on practical activities, experiments that enable them to gain first-hand experience and more importantly to reflect on what they have applied and learnt. In this way, not only would students learn effectively, it would also lead to heightened interest and inspire self-confidence.

Learning Goals and Teaching Roles

Every student is a unique learner, thus it is imperative we use a repertoire of pedagogies in order to match particular learning goals to students' needs. The use of a repertoire of teaching strategies engages students because each lesson is different and students have the opportunity to learn differently. In tandem with this, different learning goals will require different teaching roles (with their associated teaching strategies) to work together in the pursuit of identified learning results as shown in **Table 2**. ESS teachers should be cognisant that these strategies and approaches are hardly mutually exclusive but can supplement each other to enhance student learning and maximise teaching effectiveness.

Acquire	Make Meaning	Transfer
This goal seeks to help learners acquire factual information and basic skills.	This goal seeks to help learners <i>construct meaning</i> (i.e. come to an <i>understanding</i>) of important ideas and processes.	This goal seeks to support the learners' ability to <i>transfer</i> their learning autonomously and effectively in new situations.
<p><u>Direct Instruction</u> In this role, the teacher's primary role is to <i>inform</i> the learners through explicit instruction in targeted knowledge and skills; differentiating as needed.</p> <p><i>Strategies include:</i></p> <ul style="list-style-type: none"> • Lecture • Graphic organisers • Questioning (convergent) • Demonstration/modelling 	<p><u>Facilitative Teaching</u> Teacher in this role, engage the learners in actively processing information and <i>guide</i> their inquiry into complex problems, texts, projects, cases, or simulations; differentiating as needed.</p> <p><i>Strategies include:</i></p> <ul style="list-style-type: none"> • Using analogies • Graphic organisers 	<p><u>Coaching</u> In a coaching role, teachers establish clear performance goals, supervise on-going opportunities to perform (independent practice) in increasingly complex situations, provide models and give on-going feedback (as personalised as possible). They also provide "just-in-time teaching" (direct instruction) when needed.</p>

Acquire	Make Meaning	Transfer
<ul style="list-style-type: none"> • Guided practice • Feedback, corrections • differentiation 	<ul style="list-style-type: none"> • Questioning (divergent and probing) • Case studies discussion • Concept attainment • Guided practical practice • Feedback, corrections • Rethinking and reflection prompts • differentiation 	<p><i>Strategies include:</i></p> <ul style="list-style-type: none"> • Providing specific feedback in the context of authentic application • Conferencing • Prompting self-assessment and reflection

Table 2: Learning Goals and Teaching Roles (Adapted from McTighe & Wiggins, 2012)

4. ASSESSMENT

OUR ASSESSMENT PHILOSOPHY

Assessment is an integral part of the learning process, and must be closely aligned with curricular objectives, content and pedagogy. Both school-based assessment and national examinations play important and different roles in our education system. A balanced assessment system should have both Assessment of Learning as well as Assessment for Learning. Whether implemented as national examinations or in the classroom, assessment should lead to meaningful learning. The ‘what’ and ‘how’ of assessment should be anchored on the clarity of purpose (‘why’). There should be regular gathering of quantitative and qualitative information about a learner’s progress and development, and such information should be used to inform learning and shape future teaching and learning practices. The following are the three key messages of our assessment philosophy:

1. Assessment is integral to the learning process
2. Assessment begins with clarity of purpose
3. Assessment should gather information to inform future practices

THE NATIONAL EXAMINATION

The format of the national examination comprises two compulsory components: Paper 1 (E-Examination Paper) and Paper 2 (Coursework).

Assessment of Theory – Paper 1

The mode of the paper is a computer-based examination. The use of computer-based assessment will provide more dynamic and authentic contexts instead of using still pictures or descriptive passages in a pen-and-paper format. Visual stimuli on sports/exercise content will be used to test the understanding, application and analysis of the students in the national examination. It is also important to ensure the national examination features a good spread of questions targeted at different levels of difficulty to differentiate the abilities of the students at end state (i.e., Secondary 4).

Assessment of Practical Performance – Paper 2

The coursework component allows the ESS student to (a) analyse his/her development by applying the theoretical elements of sports science learned and (b) understand the interaction of these scientific concepts and factors within sports performance. These activities would strengthen the nexus between the theoretical and the practical; therefore, more time should be devoted to practice and fulfil the multiplicity of experiences and behaviours through different spaces and environments.

As part of the coursework requirement, students will choose ONE practical activity from EACH of the categories (see **Table 3**):

- 1) an **Individual / Dual Activity**¹⁴; and
- 2) a **Team Activity**.

The coursework assesses the students' proficiency in performing practical activities as they work towards fulfilling the performance assessment descriptors at a particular band of marks. The students' ability to analyse, evaluate and make improvement on their physical performance through the Development Log will also be assessed.

Students are required to complete an Individual/ Dual Practical Activity Log and a Team Practical Activity Log. The Development Log is to be completed in conjunction with the training and preparation for the two chosen practical activities. In doing so, students will explore the practical and theoretical components required to improve the performance in skills, strategies and tactics related to physical activities. They will examine basic and advanced movement patterns, apply strategic and tactical awareness and understand the analysis of movement in order to attain the level of skill performance.

¹⁴ Dual sports activities refer to sports that one can do with a partner such as badminton, tennis and fencing. (Corbin & Lindsey, 2014). For the purpose of this subject, a doubles' game in a dual sport will not be considered as a team sport.

Categories	Practical Activities
Individual/Dual	Individual <ul style="list-style-type: none"> • Cross-country Running • Swimming • Track and Field Dual <ul style="list-style-type: none"> • Badminton • Table Tennis • Tennis
Team	<ul style="list-style-type: none"> • Basketball • Floorball • Football • Hockey • Netball • Softball • Volleyball

Table 3: List of Practical Activities