# Topic 6: Measurement and Evaluation of Human Performance

### Statistical Analysis – 2 hours

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| **Group** |  | **Assessment statement** | **Obj**  **Level** | **Teacher’s notes** |
| A | 6.1.1 | Outline that error bars are a graphical representation of the variability of data. | 2 | Only standard deviation needs to be considered. |
| A | 6.1.2 | Calculate the mean and standard deviation of a set of values. | 2 | Students should specify the sample standard deviation, not the population standard deviation.  Students will not be expected to know the formulas for calculating these statistics. They will be expected to use the statistics function of a graphic display or scientific calculator.  **Aim 7:** Students could also be taught how to calculate standard deviation using a spreadsheet computer program. |
| B | 6.1.3 | State that the statistic standard deviation is used to summarize the spread of values around the mean, and that within a normal distribution approximately  68% and 95% of the values fall within plus or minus one or two standard deviations respectively. | 1 | For normally distributed data, about 68% of all values lie within ±1 standard deviation of the mean. This rises to about 95% for ±2 standard deviations. |
| B | 6.1.4 | Explain how the standard deviation is useful for comparing the means and the spread of data between two or more samples. | 3 | A small standard deviation indicates that the data is clustered closely around the mean value. Conversely, a large standard deviation indicates a wider spread around the mean. |
| B | 6.1.5 | Outline the meaning of coefficient of variation. | 2 | Coefficient of variation is the ratio of the standard deviation to the mean expressed as a percentage. |
| C | 6.1.6 | Deduce the significance of the difference between two sets of data using calculated values for *t* and the appropriate tables. | 3 | For the *t*-test to be applied, ideally the data should have a normal distribution and a sample size of at least 10. The *t*-test can be used to compare two sets of data and measure the amount of overlap. Students will not be expected to calculate values of *t*. Only two-tailed, paired and unpaired *t*-tests are expected.  **Aim 7:** While students are not expected to calculate a value for the *t*-test, students could be shown how to calculate such values using a spreadsheet program or the graphic display calculator.  **TOK:** The scientific community defines an objective standard by which claims about data can be made. |
| C | 6.1.7 | Explain that the existence of a correlation does not establish that there is a causal relationship between two variables. | 3 | **Aim 7:** While calculations of such values are not expected, students who want to use *r* and *r*2 values in their practical work could be shown how to determine such values using a spreadsheet program. |

### Study Design – 4 hours

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| **Group** |  | **Assessment statement** | **Obj**  **Level** | **Teacher’s notes** |
| D | 6.2.1 | Outline the importance of specificity, accuracy, reliability and validity with regard to fitness testing. | 2 |  |
| D | 6.2.2 | Discuss the importance of study design in the context of the sport and exercise sciences. | 3 | This should include a demonstration of causality in experimental results by the inclusion of control groups, randomization, placebos, blinding and double-blinding, statistical analysis. |
| E | 6.2.3 | Outline the importance of the Physical Activity Readiness Questionnaire (PAR-Q). | 2 |  |
| E | 6.2.4 | Evaluate field, laboratory, sub- maximal and maximal tests of human performance. | 3 |  |

* 1. **Components of Fitness – 4 hours**

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| **Group** |  | **Assessment statement** | **Obj**  **Level** | **Teacher’s notes** |
| F | 6.3.1 | Distinguish between the concepts of *health-related fitness* and *performance-related (skill- related) fitness*. | 2 | *Health-related fitness* includes body composition, cardio-respiratory fitness (aerobic capacity), flexibility, muscular endurance, strength.  *Performance-related (skill-related) fitness* includes agility, balance, coordination, power, reaction time and speed.  Some components of performance-related fitness (agility, balance, coordination) could become health-related for certain groups such as the elderly and those suffering from hypokinetic diseases. |
| F | 6.3.2 | Outline the major components of fitness identified in 6.3.1. | 2 |  |
| G | 6.3.3 | Outline and evaluate a variety of fitness tests. | 2,3 | Consider validity, reliability and limitations of the following tests:   * Aerobic capacity—multistage fitness test/ bleep test (Leger Test), Cooper’s 12 Minute Run, Harvard Step Test * Flexibility—sit and reach * Muscle endurance—maximum sit-ups, maximum push-ups, flexed arm hang * Agility—Illinois Agility Test * Strength—hand grip dynamometer * Speed—40 meter sprint * Body composition—body mass index, anthropometry and underwater weighing * Balance—stork stand * Coordination—hand ball toss * Reaction time—drop test, computer simulation * Power—vertical jump, standing broad jump   **Aim 9:** Issues of using direct and indirect measures of fitness, and the extrapolation of data and generalizations across populations could be considered. Cultural variations in the  establishment of standardized norms may also be explored.  **Aim 7:** Opportunity to use computer simulation/ modelling and databases. |

### Principles of Training Program Design – 3 hours

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| **Group** |  | **Assessment statement** | **Obj**  **Level** | **Teacher’s notes** |
| H | 6.4.1 | Describe the essential elements of a general training program | 2 | This should include warm-up and stretching activities, endurance training, cool down and stretching activities, flexibility training, resistance training and the incorporation of recreational activities and sports into the schedule.  **TOK:** Recent research questions the effectiveness of static stretching as a necessary component  of the warm-up. The difficulty of conducting controlled trials without a placebo effect could be discussed. The willingness of athletes to believe what they are told, without questioning the advice, could also be considered. |
| I | 6.4.2 | Discuss the key principles of training program design. | 3 | Limit to progression, overload (frequency, intensity and duration), specificity, reversibility, variety and periodization. |
| J | 6.4.3 | Outline ways in which exercise intensity can be monitored. | 2 | Limit to:   * use of heart rate based upon its relationship with oxygen uptake, ie target heart rate that coincides with a given percentage of maximal oxygen uptake * the Karvonen method * the training heart rate range/zone * ratings of perceived exertion (Borg/OMNI/ CERT scale ). |