Axis 2: Reading and Analyzing Scientific Articles

Lecture 2.1: Deconstructing the Empirical Research Article (IMRaD)

To participate in the global scientific community, one must master the genre of the empirical research article. The standard format for these articles is known by the acronym **IMRaD**: **I**ntroduction, **M**ethods, **R**esults, and **D**iscussion. Understanding this structure is essential not only for writing but for efficient reading and analysis.

2.1.1 The Hourglass Structure

The IMRaD format follows a conceptual "hourglass" shape:

1. **Introduction (Broad to Narrow):** Starts with general background context, narrows to the specific problem, and ends with the specific hypothesis of the study.

2. **Methods & Results (Narrow):** The "neck" of the hourglass. Focuses exclusively on the specific details of the experiment and the data collected.

3. **Discussion (Narrow to Broad):** Starts by interpreting the specific findings, then broadens out to discuss implications for the general field and future research.[12]

2.1.2 The Introduction: Rhetorical Moves (CARS Model)

John Swales' (1990) **CARS** model (Create a Research Space) is the standard framework used to analyze academic introductions. Students should look for these three "moves" when reading:

- **Move 1: Establishing a Research Territory.**

  - *Function:* The author shows that the general research area is important, problematic, or relevant.

  - *Signaling Phrases:* "Recent evidence suggests that..." "Extensive research has shown that VO2max is a critical determinant of..." "It is well established that..."

- **Move 2: Establishing a Niche.**

  - *Function:* The author highlights a gap, a problem, a contradiction, or a limitation in the existing research. This justifies the new study.

  - *Signaling Phrases:* "However, few studies have examined..." "Previous analyses have failed to account for..." "Data regarding the effects of HIIT on elderly populations remain contradictory." "Although X is known, Y remains unclear."

- **Move 3: Occupying the Niche.**

  - *Function:* The author states the purpose of the current study and outlines its structure.

  - *Signaling Phrases:* "Therefore, the purpose of this study was to..." "This paper argues that..." "We hypothesized that...".[12]

2.1.3 The Methodology: Precision and Replicability

The Methods section is the most strictly structured part of the paper. Its primary goal is **replicability**—another researcher should be able to repeat the study based *solely* on this text. When analyzing this section, students must look for:

- **Participants:** Sample size (n), demographics (age, sex, training status). *Critical Question:* Is the sample representative of the population?

- **Protocol:** The step-by-step description of the intervention.

- **Statistical Analysis:** The tests used (ANOVA, t-test, regression). *Critical Question:* Were the appropriate tests used for the data type?.[15]

Lecture 2.2: Critical Appraisal and Evidence Evaluation

Reading a scientific paper in English involves more than translation; it requires **critical appraisal**. This is the process of systematically examining research evidence to assess its validity, results, and relevance before applying it to coaching practice.

2.2.1 The CASP Framework

The Critical Appraisal Skills Programme (CASP) provides a set of checklists widely used in health and sports science to evaluate different types of studies. Students should ask three broad questions:

1. **Is the study valid?** (Did it measure what it claimed to?)

   - *Key terms to look for:* "Randomization," "Blinding" (single-blind vs. double-blind), "Control group," "Selection bias," "Confounding variables."

2. **What are the results?** (Are the findings significant?)

   - *Key terms to look for:* "P-value," "Confidence Interval (CI)," "Effect Size (Cohen's d)."

3. **Will the results help locally?** (External Validity/Applicability)

   - *Key terms to look for:* "Generalizability," "Ecological validity" (does the lab test resemble the real sport?).[16]

2.2.2 The Hierarchy of Evidence

Students must understand that not all published evidence is of equal weight.

Level	Study Type	Description	Strength of Evidence
1	**Systematic Reviews & Meta-Analyses**	Synthesize data from multiple studies to draw a stronger conclusion. The highest level of evidence.	Highest
2	**Randomized Controlled Trials (RCTs)**	The gold standard for experimental research. Subjects are randomly assigned to groups.	High
3	**Cohort Studies**	Observational studies following a group over time to see outcomes.	Moderate
4	**Case Studies / Case Reports**	Detailed analysis of a single athlete or team. Useful for unique phenomena but low generalizability.	Low
5	**Expert Opinion / Editorials**	Based on experience rather than data.	Lowest

.[19]

Lecture 2.3: Statistical Literacy for Sports Scientists

To analyze articles effectively, students need a working knowledge of statistical English.

- **P-value:** The probability of observing the results if the null hypothesis were true.

  - *Reading tip:* A p-value < 0.05 indicates statistical significance, meaning the result is unlikely to be due to random chance. However, it does not measure the *magnitude* of the effect.

- **Effect Size (ES):** Measures the *strength* or *magnitude* of the relationship.

  - *Reading tip:* A study might have a significant p-value (p=0.04) but a trivial effect size (d=0.1). This means the difference exists but might not be practically relevant for a coach.

- **Confidence Interval (CI):** A range of values so defined that there is a specified probability that the value of a parameter lies within it.

  - *Reading tip:* Narrow CIs indicate high precision; wide CIs indicate uncertainty.[15]