SCAT CONCUSSION IN SPORTS

# Training Guide for Vocational Education and Training (VET) Providers

Co-funded by the Erasmus+ Programme of the European Union

# Table of Contents

# Foreword:

This Training Guide has been developed as a primary output of the European Erasmus+ funded project *Get your head in the game - sports concussion awareness and training (SCAT)*. This project is led by Galway-Mayo Institute of Technology (GMIT), Ireland, in partnership with the Oxford Brookes University (UK), the International Concussion and Head Injury Research Foundation (UK), University of Southern Denmark (Denmark), La Trobe University (Australia) and Letterkenny Institute of Technology (Ireland).

The main aim of the SCAT project is to develop an in depth understanding of the implications of concussion in a sport and exercise setting by equipping VET educators with an innovative pedagogy guide. The training guide is informed by the findings of a systematic literature review and supported by a module that will provide VET educators with the knowledge and materials to develop concussion specific training. A key aspect of this project is to encourage the growth of professional development of VET educators and to develop innovative teaching approaches. A secondary objective of the project is to contribute to a culture of openness and dissipate the uncertainty and fear surrounding concussion in contact sports by making resources, current research, and information available to the public via the online Module.

Concussion is a significant issue in sport and physical education. In the United Kingdom, somebody is admitted to hospital every 3 minutes with a head injury (Headway, 2020). In Denmark around 25,000 people attend the emergency room with concussion every year. A central issue is that concussion is an “invisible injury” – we cannot physically see where a person has been injured as it manifests in an internal manner that is difficult to diagnose, comprehend and explain.

Interestingly, formal training in concussion has not been delivered as part of health-related VET programmes and many VET providers do not feel they have the skills and knowledge to train their students in concussion.

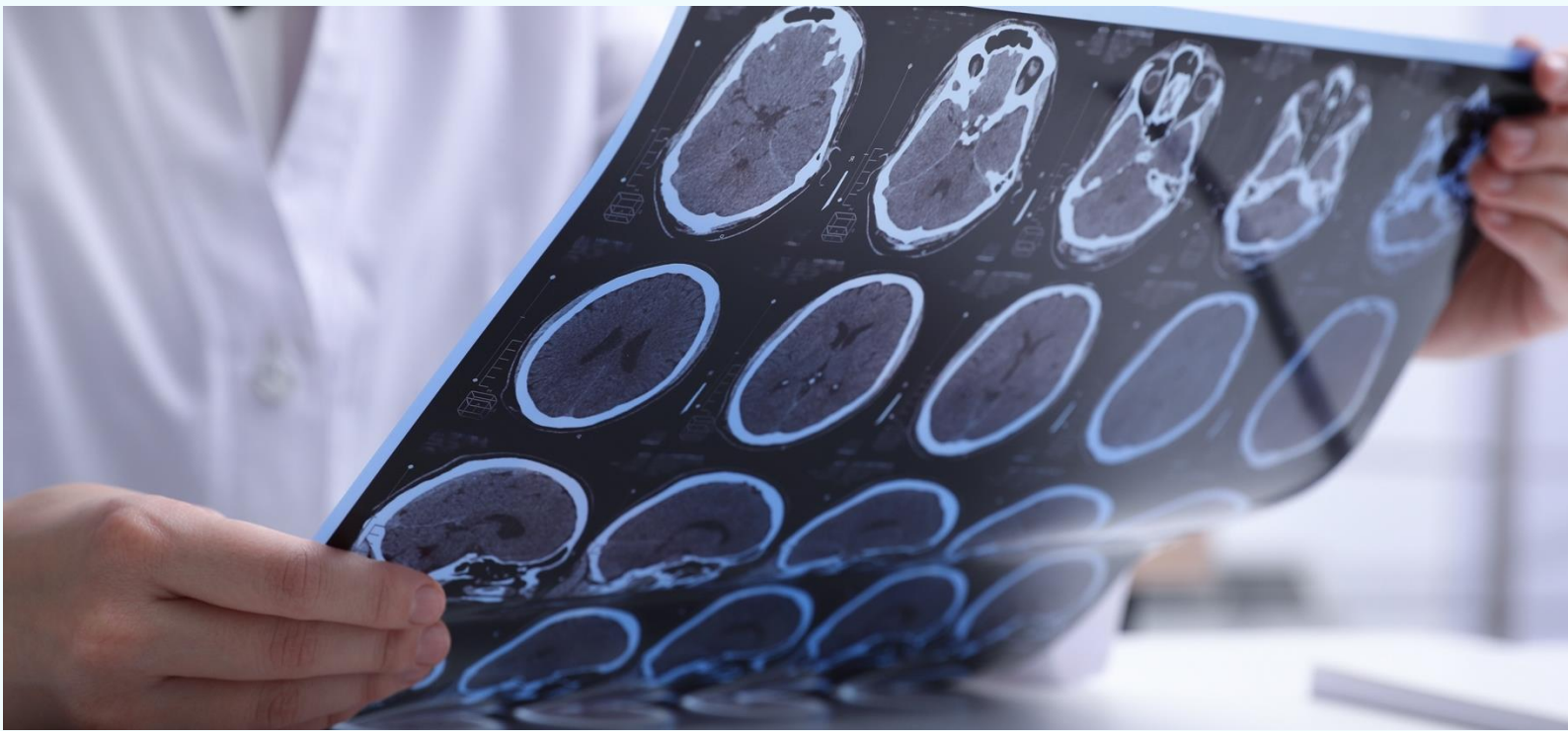
The project outputs are intended to shed light on this invisible injury and ensure that continuing professional development is provided for VET providers in this important area.

## Overview

This training guide has been designed for VET providers to enable them to develop and deliver concussion specific education. The training guide has been developed in consultation with industry experts, academics, and practitioners. The guide was informed by the results of a survey carried out with educators, coaches, and others involved in wider sport community (appendix one) and by using information from the systematic review produced as part of this project. The type of training methodology introduced in the guide moves away from the traditional theory-based learning that is used in concussion education. It explores practical learning methods of teaching and learning to allow active participation and engagement. In addition to this, the training guide introduces a range of innovative teaching mechanisms and provides a variety of information to VET providers on how to pitch suitable training content and practical learning that will provide the students with the supports required for successful growth in this sector. The guide includes recommendations on how to develop and roll out concussion training that can be used as a reference point when developing learning materials.

In summary, the Training Guide provides VET trainers with the knowledge and resources required to develop a training course that will:

- provide concussion education specific to their contexts.
- introduce innovative, flexible, and practical methodologies of training delivery.
- meet the identified training needs of learners in sport and health related programmes.



## Who is this guide for?

This guide has been developed to allow a broad audience to utilise it within their contexts and organisations. This can include the following:

- VET educators (primary target group)
- Secondary and Further Education teachers delivering sport health and physical education courses
- Higher Education lecturers
- Coach educators
- Sports Coaches (amateur and elite)
- Athletes
- Wider sports community

## Core Messages

There are several core messages that are consistent throughout this training guide:

1. Concussion is a brain injury and should be recognised and acknowledged by those involved in sport.
2. Managing and preventing concussions is everybody's responsibility.
3. The symptoms of concussion usually resolve within four weeks but can take a longer duration.
4. Concussion is an invisible injury and vigilance is key to recognising its signs and symptoms.
5. If in doubt, sit them out: a focus on recognising suspected concussions and removing that person from play.
6. Concussion education and management strategies will contribute to reducing the risk of concussion in sport.
7. If in doubt, seek medical attention.
8. There is a need to change the culture of recognising, reporting, and speaking up about concussions so that athletes do not play sport or engage in high-intensity physical activity when concussed.

## Concussion Education and the need for cultural change:

Education initiatives are a widely used strategy for addressing concussion in grassroots sport and physical education. This is based on the notion that education may be able to change prevailing beliefs and attitudes towards concussion. Education programmes focus on training stakeholders, such as sports first aid people but also coaches and parents on recognising the signs and symptoms of concussion and basic strategies on how to manage them in the sporting context. Fraas and Burchiel (2016) in their systematic review of education programmes to prevent concussion found that there was a dearth of evidence to support the effectiveness of such programmes, with innovative behaviour change work urgently required. More recently education programmes have aimed to educate athletes themselves. However, there is a lack of evidence to suggest these initiatives change the attitudes or behaviours of athletes to remove themselves from play when concussed.

## Reporting Concussion:

Concussion research has consistently positioned athletes/players as underreporting the signs or symptoms of concussion (Malcolm, 2017). The most frequently cited reasons for this behaviour tend to be based on knowledge and/or commitment, as athletes/players cite:

- They are unaware they have been concussed or, do not believe their symptoms to be important.
- Deciding to continue participating either because of a desire to play on, or because they did not want to let their teammates/coach/club down.

The result is players remain on the field, they do not report their concussions and subsequently are at risks of further harm. To challenge these behaviours, there is a need to look beyond latent understandings of sporting norms (including under-reporting) and question the deeper social processes at place. Certainly, such understanding is vital to support behaviour change in this setting.

There is a cultural issue when it comes to reporting concussion. In order for a lasting and significant change to take root, new cultural 'formations' need to be created and embedded within practitioners' everyday practice and contexts. Athletes need to be educated and supported in recognising and reporting concussion.

Positioning students/participants as 'agents of change', the online training module that will be developed as an output of the project (led by Southern Denmark University), will explore interventions-based on behaviour modification. However, as these initiatives often occur in isolation, substantive change can at times be a slow and ineffective progress. Such interventions might be considered at micro-level (practitioner/player) cultural interactions and need to also be supported at the meso (sport/club) and macro (Societal) levels of cultural change. The module will also provide a range of interactive resources for dissemination, training, and implementation.

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## Evidence base

This guide has been developed by an inter-disciplinary consortium of professionals who have expertise in concussion, sport, and pedagogy. A systematic literature review has been conducted by the consortium: *An assessment of current concussion identification and diagnosis methods in sports settings. A systematic review*. This output aimed to understand the current ways for identifying and diagnosing concussions in sport. The key findings are highlighted below.

A wide variety of assessments were used to identify and diagnose concussion injuries in athletes pitch-side. Cognitive testing, for reaction time, memory, and concentration, was most commonly used (56%), followed by observation (8%), visual eye movement testing (8%), and a combination of all three (8%). Athletes played a variety of sports, 56% were professional or semi-professional and had access to trained medical personnel. In contrast, 36% of athletes played at amateur or community level and had an increased likelihood of limited medical resources. Overall, the majority of assessments were performed by medical personnel (88% - doctors, clinicians, orthopaedic support, neurologists, or with the assistance of certified athletic trainers or physiotherapists). The remainder were non-medical trained personnel

Cognitive tests, such as the King Devick (KD) and the SCAT5 (administered by a medical professional) were the most widely used at pitch-side settings. These tests were most effectively used in combination with additional tests such as the observational Balance Error Scoring System ((BESS) requires training), and Vestibular/Ocular Motor Screening ((VOMS) administered by a medical professional) tests. However, many of the studies included in this review (33%) were conducted at non-elite levels (amateur and community sport). This is primarily due to a shortfall of trained personnel who can administer HIA as most pitch side assessments require specialist training. This creates obstacles to a more comprehensive assessment and pitch-side management of concussed players in amateur and community sport. Assessments which require specialist training cannot be performed at non-elite levels where access to medical resources or trained personnel may be limited. In conclusion, the focus of research and education needs to transfer to those who coach and manage non-elite athletes and non-elite sports as this is where the majority of concussions occur but is not being sufficiently researched at present.

# Section One:
# Indicative Content

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## What is a concussion

Sport related concussion is a traumatic brain injury induced by biomechanical forces (a blow/impact to the head or body). This impact causes the brain to bounce inside the skull, resulting in injury. This can be to the body or head. It results in a change to how the brain works.

## Signs and Symptoms of concussion

CONCUSSION RECOGNITION TOOL 5 ©

To help identify concussion in children, adolescents and adults

Supported by FIFA

RECOGNISE & REMOVE

Head impacts can be associated with serious and potentially fatal brain injuries. The Concussion Recognition Tool 5 (CRT5) is to be used for the identification of suspected concussion. It is not designed to diagnose concussion.

STEP 1: RED FLAGS — CALL AN AMBULANCE

If there is concern after an injury including whether ANY of the following signs are observed or complaints are reported then the player should be safely and immediately removed from play/game/activity. If no licensed healthcare professional is available, call an ambulance for urgent medical assessment:

- Neck pain or tenderness
- Double vision
- Weakness or tingling/ burning in arms or legs
- Severe or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless, agitated or combative

Remember:

- In all cases, the basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Assessment for a spinal cord injury is critical.
- Do not attempt to move the player (other than required for airway support) unless trained to so do.
- Do not remove a helmet or any other equipment unless trained to do so safely.

If there are no Red Flags, identification of possible concussion should proceed to the following steps:

STEP 2: OBSERVABLE SIGNS

Visual clues that suggest possible concussion include:

- Lying motionless on the playing surface
- Slow to get up after a direct or indirect hit to the head
- Disorientation or confusion, or an inability to respond appropriately to questions
- Blank or vacant look
- Balance, gait difficulties, motor incoordination, stumbling, slow laboured movements
- Facial injury after head trauma

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STEP 3: SYMPTOMS

- Headache
- "Pressure in head"
- Balance problems
- Nausea or vomiting
- Drowsiness
- Dizziness
- Blurred vision
- Sensitivity to light
- Sensitivity to noise
- Fatigue or low energy
- "Don't feel right"
- More emotional
- More irritable
- Sadness
- Nervous or anxious
- Neck Pain
- Difficulty concentrating
- Difficulty remembering
- Feeling slowed down
- Feeling like "in a fog"

STEP 4: MEMORY ASSESSMENT

(IN ATHLETES OLDER THAN 12 YEARS)

Failure to answer any of these questions (modified appropriately for each sport) correctly may suggest a concussion:

- "What venue are we at today?"
- "Which half is it now?"
- "Who scored last in this game?"
- "What team did you play last week/game?"
- "Did your team win the last game?"

Athletes with suspected concussion should:

- Not be left alone initially (at least for the first 1-2 hours).
- Not drink alcohol.
- Not use recreational/ prescription drugs.
- Not be sent home by themselves. They need to be with a responsible adult.
- Not drive a motor vehicle until cleared to do so by a healthcare professional.

The CRT5 may be freely copied in its current form for distribution to individuals, teams, groups and organisations. Any revision and any reproduction in a digital form requires approval by the Concussion in Sport Group. It should not be altered in any way, rebranded or sold for commercial gain.

ANY ATHLETE WITH A SUSPECTED CONCUSSION SHOULD BE IMMEDIATELY REMOVED FROM PRACTICE OR PLAY AND SHOULD NOT RETURN TO ACTIVITY UNTIL ASSESSED MEDICALLY, EVEN IF THE SYMPTOMS RESOLVE

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872 Echemendia RJ, *et al*. *Br J Sports Med* 2017;**51**:872. doi:10.1136/bjsports-2017-097508CRT5

There are many signs and symptoms of a concussion.

These include:

## Signs

| | | | | |
|---|---|---|---|---|
| Headache | Nausea | Dizziness | Blurred-vision | Photosensitivity |
| Noise sensitivity | Emotional | Loss of consciousness | Feeling low | Memory-loss |

## Symptoms

| | | | | |
|---|---|---|---|---|
| Performance loss | Reduced coordination | Unbalanced | Emotional: crying, frustration | Irritability |
| | Not feeling right | 'In a fog' | Cognitive deficits | |

## What does a concussion look like in the sporting context?

In the sporting context, at times it can be hard to spot concussions while a game is taking place. Griffin et al. (2021) have developed the **BUMP** and **OUCH** principles to consider in a context that may indicate a concussion has occurred:

| | |
|---|---|
| **B** | **B**alance Disturbance |
| **U** | **U**nconscious |
| **M** | sy**M**ptoms and other clinical signs |
| **P** | **P**osturing |
| **O** | **O**n the floor after play has moved away |
| **U** | **U**nsteadiness in any position |
| **C** | **C**omposing themselves on their knees before standing |
| **H** | **H**olding their head/face after impact |


There are many immediate life and brain threatening events.
All of the following require immediate emergency medical attention.


**Note**: though this is not a guide for emergency/basic first aid, basic life support principles apply when approaching a concussion. Any loss of consciousness needs to be treated with caution with regards to their airway and breathing. Please also be cautious with spinal injuries which might not be apparent with loss of consciousness. If in doubt, always call for emergency medical assistance. 999 or 112 in the UK and 112 in Europe

The list of signs and symptoms of concussion are indicative of how they might look when an athlete or student is injured. Though not all symptoms will be present in all cases, and some are much more subtle. The symptomatic presentation for concussion is very diverse and may present differently in different cases and timeframes, with many appearing hours and days later.

## How is a concussion caused?

A concussion is caused by a force to the body or head. This can often be seen in a tackle, collision, or impact with a playing surface like a football field. It is important to remember that the impact does not have to be direct to the head and can still lead to a concussion. These indirect injuries are much more subtle and are more difficult to witness or identify. One of the most commonly identifiable indirect forces for a concussion would be the whiplash of after a tackle or collision. This mechanism means that the point of contact could be anywhere on the body of an individual instead of a connection point on the head.

## What is happening when someone gets a concussion?

There are two theories for a concussion:

1. Diffuse Axonal Injury suggests that the axons, the connective wires in the brain, stretch and shear as a product of the forces experienced in the brain.
2. The second is a biochemical theory whereby the concussion causes an energy crisis in the brain by increasing energy demand, decreasing energy supply, and altering metabolic resources (Walton et al., 2020). This prevents the brain's ability to send messages, a process known as action potential, which requires energy to resolve.

## Assessment Tools for Concussion

For trained clinicians the Sport Concussion Assessment Tool, now in its 5th iteration (SCAT5), lists potential symptoms and uses testing for cognitive signs. The SCAT5 has been developed alongside the Concussion in Sports Group Consensus (see McCrory et al. 2017). The tool is not without criticism and is not necessarily sensitive for all concussion. The tool initially was aimed for professional sports which was converted into a pocket edition for non-specialised practitioners to identify symptoms of suspected concussions in grassroots sport. Importantly, the diagnosis of a concussion remains subjective and based upon the presenting symptoms and signs; and it is widely recommended that any indication of any signs and symptoms should lead to removal from activity and seeking medical attention. It is the role of coaches, officials, VET educators, and the wider sporting community, to recognise the signs and symptoms and remove athletes from play who display those signs and symptoms. If there is any doubt, medical assistance should be sought.

The Concussion Recognition tool 5 is a useful check sheet for any stakeholder in sport. (CRT5)

## What is second impact syndrome?

Second impact syndrome (SIS) occurs when participants receive two or more concussive injuries either on the same day or within the acute stages of recovery. In SIS, neurometabolic cascades can exist and have resulted in some cases of severe symptoms, however this is rare.

## What is Chronic Traumatic Encephalopathy (CTE)

Chronic Traumatic Encephalopathy (CTE) is a neurodegenerative disease associated with repetitive head impacts with recent analysis suggesting that this relationship may be causal (Nowinski et al., 2022). Emerging evidence shows that CTE can occur in any contact sport athlete, therefore, proper recovery protocols need to be reviewed to highlight that reducing the number and severity of impacts may contribute significantly to CTE mitigation. CTE is a relatively 'rediscovered' disease, and with that its evolution is greatly debated; therefore, it requires further research.

## What are the rates of concussions in different sports?

Comparing the rates of concussions between different sports can be challenging, and often to do this a common denominator or measurement is needed. The easiest way of doing this is to work out the number of concussions per 1000 hours of participation or 1000 athlete exposures (with each time someone participates being classified as an exposure). Pfister et al. (2016) conducted a systematic review of concussions in youth sports and found the following rates per sport:

**Table 1: Number of concussions per 1000 hours of participation or 1000 athlete exposures**

| Sport | Male (Per 1000 athlete exposures) | Female (Per 1000 athlete exposures) |
|---|---|---|
| American Football | 0.53 | Not reported |
| *Australian Football | 7.4 | |
| Football / soccer | 0.19 | 0.27 |
| Basketball | 0.10 | 0.17 |
| Baseball | 0.06 | Not reported |
| Wrestling | 0.17 | Not reported |
| Lacrosse | 0.29 | 0.17 |
| Ice Hockey | 1.20 | |
| Softball | Not reported | 0.10 |
| Rugby | 4.18 | Not reported |
| Volleyball | Not reported | 0.03 |
| Field hockey | Not reported | 0.10 |
| Cheerleading | Not reported | 0.07 |

* 2021 AFL injury report

It is important to highlight that it is widely accepted that concussions are under-reported and these values likely under-estimate the risks and incidence of concussions.

Another systematic review conducted by Prien et al (2018) found the following rates in contact sports in athletes under 18 years of age:

**Table 2: Concussion rates in contact sports in athletes under 18 years of age**

| Activity | Measure | Rate |
|---|---|---|
| Men's football/soccer | Per 1000 hours | 0.44 |
| | Per 1000 athlete exposures | 1.07 |
| Women's football/soccer | Per 1000 hours | 1.76 |
| | Per 1000 athlete exposures | 1.48 |
| Men's rugby | Per 1000 hours | 3.89 |
| | Per 1000 athlete exposures | 3.00 |
| Men's Ice Hockey | Per 1000 hours | 2.01 |
| | Per 1000 athlete exposures | 1.63 |
| Women's Ice Hockey | Per 1000 athlete exposures | 2.27 |
| Men's American Football | Per 1000 athlete exposures | 2.52 |

## How long do concussions take to resolve?

While many concussions resolve quickly, over the course of a few days or weeks, some can experience symptoms that can persist for many weeks, months, and even years. Where symptoms last longer than four weeks (or 28 days) it is deemed to be persistent post-concussion symptoms, sometimes referred to as Post-Concussion Syndrome (Hall, Hall & Chapman, 2005). In the case of persistent symptoms specific advice and treatment should be sought from a healthcare professional.

## Returning to sport

Knowing when a player is ready to safely return to playing sport following a concussion is one of the biggest concerns that needs to be addressed. Many now accept a stepwise return to competition protocols is now based around this six-stage timeline (see Table 3 below), under the supervision of a medical practitioner. This graduated return to play system mediates that each stage takes a ***minimum*** of 24 hours, and that the player must be able to undertake the required activities without reporting or doctor noting any symptoms. However, emerging evidence is suggesting that symptom resolution may not be a true indicator that a player has fully recovered. Moreover, epidemiological evidence suggests a 2.4-fold risk of musculoskeletal and anterior cruciate ligament injuries following a concussion, that has been suggested due to ongoing impairments of the motor system despite clinical symptom resolution (McPherson et al., 2019). Therefore, further objective measures, incorporating, vestibular ocular motor (VOMS) screening which examines vestibular reflex, vision, and other movement characteristics or biomarkers (e.g., specific proteins in saliva), may assist the clinical prognosis. These additional tests may assist in return to play signoff from a medical practitioner or doctor who is currently relying on athlete report and/or clinical subjective judgement.

Conversely, despite mandated policies from national governing bodies, it appears that some clubs and players may not be adhering to the minimum standards set out in the return to play guideline protocols (Table 3). For example, research conducted by the Rugby Football Union found poor adherence to the return to play protocols. For instance, in 2017-2018, 23% of concussions returned to play sooner than the ***minimum*** return to play timeframe. This worsened with 31% returning before the minimum rest period in the 2018-2019 season (Rugby Football Union, 2020).

**Table 3: Graduated Return to Play Process**

| Graduated Return to Play Process | | |
|---|---|---|
| **Stage** | **Function** | **Examples** |
| **1 No Activity** | Rest and recovery | |
| **2 Light** | Increased heart rate | Walking, low intensity stationary cycling, swimming |
| **3 Sport-specific exercise** | Add movement | Running drills, skating drills |
| **4 Non-contact drills** | Exercise and cognitive load | Passing drills and potential resistance training |
| **5 Full-contact practice** [Following medical clearance] | Restore confidence and assess skills | |
| **6 Return to play** | | Normal Game Play |

## Returning to Work/Education

Like return to play, considering how a concussed athlete returns to a full active 'life' after concussion or returns to learn or work is important for their well-being. Like activity, it is important to take a phased and progressive approach to returning to education, ensuring success at each stage. The UK Acquired Brain Injury Foundation have published guidance for schools to return to education that may be a useful guide to support the development of return to education plans for young people. Referring to national sporting bodies across Europe should be considered to ascertain if similar guidelines are in in place for relevant countries.

# Section Two: Teaching & Learning Approaches

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## Introduction to teaching and learning approaches

To date there has been a distinct lack of concussion related information delivered as part of health related, sport and exercise programmes, leaving VET providers feeling ill equipped to deliver concussion specific training. This training guide will enable educators to deliver research informed (O1) information on concussion management. The guide will introduce innovative teaching mechanisms aimed at boosting knowledge and understanding. It will also provide educators with an appreciation of the complexities associated with the management and development of concussion-based training at a VET Institution.

## Training set-up

When delivering concussion education, much of the work happens outside of the workshop. This involves finding the right trainers, location, delivery approach and resources.

## Delivery

Below is a brief description of the variety of delivery methods that can be implemented by educators. It is encouraged that sessions involve lots of activities so that learners can interact and construct their knowledge in a low-risk and social context.

- Peer-to-peer learning: Peer-to-peer learning provides an informal and encouraging learning environment predicated on tasks that are active, creative, and social. The potential benefits of peer-to-peer teaching are documented in the educational literature as active-learning approaches. Educational researchers and theorists who are proponents of peer-to-peer teaching, emphasize the importance of providing appropriate (planned and differentiated) scaffolding/support for students.

- Experiential Learning: This approach requires a non-traditional learning environment (seminar style spaces over lecture theatres) that blends teaching and assessment techniques. It is recommended that peer and experiential learning are at the core of the course modules, thus enabling students to content ground in applied practice/knowledge.

- Classroom/Lecture: Traditional style classroom activities, more didactic than the vehicles discussed above (the providing of information). To be used in a low proportion throughout the course content.

- Online Learning: Access to learning activities and experiences via the use of some technology through online classroom Learning, video, webinars, podcast, and other useful channels.

- Student Reflection: The practice of reflection should be commonplace in the course to ensure the students are analysing their relationship with the content and context of the course, whilst challenging personal assumptions and biases driven by socialised knowledge. It also serves as a reference guide after the course has been completed.

- Facilitation: Effective facilitation by lecturers and mentors will drive a significant portion of the learning outcomes. The facilitators should guide and allow discussions, debates, and student interactions to help the group achieve learning goals.

- Debate: Recent studies have found debate as a pedagogical vehicle to be effective in enabling the learning of skills and content within health education. Specifically, debate has been seen to support the development of skills such as communication, critical thinking, and teamwork.

- Case based learning (CBL) / scenario-based learning*:* CBL is a teaching tool used in a variety of medical/clinical fields using human cases to impart relevance and aid in connecting theory to practice. The impact of CBL can reach from simple knowledge gains to supporting behaviour change practices.

- Self-Directed learning*:* Timetabled learning where the students, with guidance from an instructor, take ownership of their own learning by managing personal engagement. It can be done individually or via group learning.

## Assessment Strategies:

In line with contemporary pedagogic thinking, it is recommended that a mixed approach to assessment be taken throughout the module, reflective of practitioner's lived experiences of managing concussion education and debates, all ground in the thinking of 'Assessment for Learning'.

Reflective Journal: The reflection journal is a detailed description of the student's insights in relation to the course topics. This is a personal reflection and therefore answers/content from students will vary. Reflections would be normally graded on the pass or fail basis relating to the informed criticality of the content.

Project Report: The course could encompass a group project, undertaken concurrently throughout the module. This may include a discussion of the project methodologies, its outcomes, and recommendations. This project should be assessed on a percentage basis based on a marking scheme, which will be developed by course providers.

Project Presentations: Project presentations should be a core component of the course with students being required to present the results of their project. The presentations should be assessed on content, relevance, and presentation skills. Marks should be awarded on presentation quality, use of visual aids and time keeping.

Continuous formative assessments: The course should include continuous formative assessment of specific knowledge and skills, i.e., Critical debate, the presentation/communication of complex information and understanding.

## Resources

For this session, we advise the following resources:

- Classroom with sufficient spaces for students (cabaret style) would be preferable
- ICT Equipment (i.e., Computer or Laptop)
- Audio-visual equipment (such as a projector or large TV)
- Any worksheets and learning resources developed
- Flip chart paper and pens
- Sticky notes
- Paper for individuals

# A Guide for Developing a Training Session

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## Learning Aims and Outcomes

*The session is complemented by the development of a specific training module (IO3): "How to explain the Invisible".*

| | How to explain the invisible: Sport Concussion Awareness & Training |
|---|---|
| **Description:** | The purpose of the training sessions is to explore the complexity and practicalities of sport-related concussion for future exercise scientists, VET educator, athletes, and the wider sporting community. To this end, the training will provide an overview of the current evidence on sport-related concussions, including recognition, prevention, management, and practical considerations. It will explore core resources, contemporary understandings/debates, and challenges present within the field. |
| **Learning Outcomes:** | On completion of this training, students will be able to:<br>• Demonstrate an understanding of the signs and symptoms of a sport-related concussion.<br>• Identify the indicators of serious head injuries.<br>• Discuss the mechanisms of a sport-related concussion.<br>• Explain the methods available to prevent a concussion.<br>• Explain and justify the use of return to play guidance in the community sport.<br>• Discuss the protocols that are in place and why. |

## Session 1: What is a Concussion

**Description**

Within this session students will gain an understanding of the 'invisible injury' that is concussion. This session will look to consider a definition of concussion and investigate the identification of concussions by outlining the signs, symptoms, and mechanisms. Additionally, the session aims to explore delayed and prolonged symptomatology.

**Learning Outcomes**

On completion of session 1, students will be able to:

- Demonstrate an understanding of the signs and symptoms of a concussion
- Identify the indicators of serious head injuries
- Discuss the mechanisms of a concussive head injury

| Activities | Resources | Key Learning Points |
|---|---|---|
| **Q:** What is a concussion?<br><br>**Task:** In groups, discuss what you think is a concussion?<br><br>**Prompts:**<br>How is it caused? (mechanism)<br>How may we recognise it?<br><br>**Feedback:** Jot collective feedback on board. | Flip chart paper and pens | A concussion is a traumatic brain injury<br><br>Caused by biomechanical forces to the head or body.<br><br>It is an invisible injury<br><br>There are many signs and symptoms i.e., Headache, Disorientation/Confusion, Nausea, Vomiting, Dizziness, Blurred Vision, Loss of Consciousness |
| **Task:** What aspects did you not have on your sheet? What else could you add? | Flip chart paper | |
| **Q:** What signs and symptoms are there for a concussion?<br><br>**Task:** Write down all the signs and symptoms of a concussion on individual sticky notes. [pairs / groups]<br><br>**Feedback:** As a whole group, consider and discuss the signs and symptoms identified by the task. (Ask probing questions to ensure understanding of each of the signs and symptoms). | Sticky notes | Have a knowledge of the signs and symptoms of a concussion. |

| | | |
|---|---|---|
| **Task:** Organise the signs and symptoms on sticky notes them into the following categories:<br><br>- Cognitive<br>- Somatic<br>- Mood<br>- Sleep<br><br>[groups] | Sticky notes | Discuss what symptoms and signs are easiest to identify and recognise.<br><br>What aspects are immediate (i.e., Cognitive and Somatic) and what may be more delayed (i.e., sleep). |
| **Q:** Where may concussions occur in physical education and sport?<br><br>**Task:** In groups, think about the different scenarios whereby concussions may happen in physical education and sport?<br><br>[groups]<br><br>(**Note:** this can be a discussion, scenario development or can be delivered in role plays) | Flip chart paper | Identify why the scenarios may lead to concussions, for instance contact to the head or contact to the body that may lead to a concussion. |
| **Q:** In your environment, how can you ensure that you see signs and symptoms for concussion in your practice?<br><br>**Task:** Discuss how will you ensure that you are able to identify the signs and symptoms of concussions with your students and athletes?<br><br>[groups] | Paper for individuals to jot notes | Ensure a concerted effort to look for signs and symptoms.<br><br>Make the recognition of signs and symptoms everyone's responsibility.<br><br>Take time to deal with injuries.<br><br>Look for concussion mechanisms as well as signs and symptoms. |
| **Q:** What signs and symptoms of concussions would you see are red flags?<br><br>**Task:** Class discussion<br><br>[whole group] | None | Loss of consciousness, seizures, vomiting, crushing headaches, suspected head/spine injury.<br><br>If any red flags are observed, then the person should attend hospital immediately/call emergency services. |

## Session 2: Concussion Reduction and Management

**Description**

Building on session 1, this session tackles the debates in concussion reduction and mitigating risk. In doing so, students will explore the notion of concussion 'reduction', risk identification and management, and consider the duty of care practitioners have over the athletes in their charge. The session will also cover the management of the acute and chronic symptoms of concussion, and discuss the implications associated with return to play protocols.

**Learning Outcomes**

On completion of session two, students will be able to:

- Understand and explain the methods available to reduce concussion incidence.
- Apply knowledge and understanding from the symptoms of concussion to its management.
- Explain and justify the use of return to play guidance in the community game. Discuss the protocols that are in place and why.

| Activities | Resources | Key Learning Points |
|---|---|---|
| **Recap:**<br><br>**Task:** In your groups, create a list of five key things that you learnt from session one.<br><br>[Groups] | Flip chart paper | Various – See session one. |
| **Q:** Can we prevent or reduce concussions in sport?<br><br>**Task:** Group discussion on how to prevent or reduce concussion in sport? | Board for group feedback | Explore why they think each method prevents or reduces concussions. |
| **Teacher-led:** Explain the hierarchy of risk controls and how they may be used in a non-sporting context. | AV Equipment | Educating stakeholders on and creating awareness of sport safety methods will reduce the risk of concussions in sport |
| **Q:** What should you do in the event of a concussion?<br><br>**Task:** in pairs, discuss what you should do when you see a concussion? [pairs] | Paper in pairs | Recognise the signs and symptoms<br><br>Remove from play<br><br>Advise seeking medical attention |

| | | |
|---|---|---|
| **Task:** In small groups, develop a scenario and develop a role play to show a concussion in sport, considering how you may manage the concussion when you have seen it? [groups] | None | Clear mechanism of a concussion<br><br>Recognise the signs and symptoms<br><br>Remove from play<br><br>Advise seeking medical attention |
| **Q:** Consider some of the potential challenges that occur in people recognising and managing concussions?<br><br>**Task:** Add into your scenario a challenge that is seen in recognising and managing concussions? [groups]<br><br>**Q:** How may you address or prevent these challenges in your contexts? | None | Difficult to recognise symptoms<br><br>Lack of confidence / uncertainty<br><br>Pressure to keep players on<br><br>Internalised pressure to stay on the field for players<br><br>Unsighted mechanisms<br><br>Parental pressures to allow to continue<br><br>Referees feeling it is not their role. |
| **Teacher-led:** Share the graduated return to play and graduated return to learn processes.<br><br>**Q:** Why is this important? | AV Equipment | Each stage must be symptom-free before progressing.<br><br>Onset of symptoms means reverting to previous stage |
| **Task:** Add in some advice on Graduated Returns within your scenario, considering the challenges that may be faced by parents, athletes, coaches, other teammates etc. | None | Firm and clear guidance is required.<br><br>Always refer to a medical practitioner.<br><br>24 hours at each stage<br><br>Any symptoms must return to previous stage. |

## Session 3: Beyond Concussion: Physiological and Social Considerations

**Description**

This session will expand on those that preceded it by exploring the potential longer-term consequences of concussion and repetitive head injuries, whilst considering the more immediate concerns of continuing to play on with a concussion. Beyond this, students will be challenged to consider and discuss the broader culture/behaviour change with respect to concussion debates.

**Learning Outcomes**

On completion of session 3, students will be able to:

- Explain and discuss the impact of continuing to play on with a concussive injury.
- Understand and examine the long-term implications of concussion.
- Identify and discuss key cultural debates surrounding concussions, their management, prevention, and reporting.

| Activities | Resources | Key Learning Points |
|---|---|---|
| **Q:** What are the impacts of ignoring concussions and continuing to play?<br><br>**Task:** In small groups, explore some of the impacts of participating on with a concussion?<br><br>**Prompts:**<br>- Decreased performance<br>- increased risk of injury<br>- Post concussion syndrome<br>- Second impact syndrome | AV Equipment<br><br>Phone, Laptop, Computer with Internet access | General overview of:<br><br>- Persistent Symptoms<br>- Further injury<br>- Second impact syndrome<br>- CTE<br>- Dementia |
| **Task:** Groups to present their findings to the whole class on each of the topic areas | None | |
| Q: What should we do about these long-term issues?<br><br>Think, Pair, Share | None | Consider implications such as informed consent. Parents rights. Cultural change. |

## Online Resources

There are a variety of online resources that are useful at programme development stage.

| | |
|---|---|
| TedEd: What happens when you have a concussion? - Clifford Robbins | Link |
| Concussion and Return to Learn – Doc Mike Evans | Link |
| Heads Up Concussion Education Video | Link |
| Disrupting Concussion Education: Team Up Speak Up \| Chris Nowinski \| TEDxBeaconStreetSalon | Link |
| Heads up to youth sport: Online Training (Centre for Disease Control) | Link |
| Sport Scotland Concussion Guidelines | Link |
| Sport Recreation Alliance Concussion for the education setting | Link |
| Can I Have Your Brain? A Quest for Truth on Concussions & CTE \| Chris Nowinski \| TEDxBeaconStreet | Link |
| England Rugby: Don't be a Headcase | Link |
| Headstrong: Shining the Light on PCS \| Esther Lovett \| TEDxYouth@BeaconStreet | Link |
| Frontline: League of Denial | Link |
| National Olympic Committee and Sports Confederation of Denmark (DNOC) e-learning on concussion in sport (in Danish) | Link |
| National Olympic Committee and Sports Confederation of Denmark (DNOC) website on concussion in sport (in Danish) | Link |
| GAA Concussion pages | Link |
| IRFU Concussion pages | Link |
| CARE Consortium Research: Concussion Recovery | Link |

## Additional resources hyperlinks used throughout the guide

- https://www.nhs.uk/conditions/head-injury-and-concussion/
- https://www.cdc.gov/headsup/basics/concussion_danger_signs.html#:~:text=Repeated%20vomiting%20or%20nausea%2C%20convulsions,consciousness%20should%20be%20taken%20seriously.
- https://doi.org/10.1002/ana.26082
- https://doi.org/10.1016/j.jsams.2019.06.007
- https://www.irishtimes.com/sport/rugby/i-ask-myself-did-we-get-justice-for-ben-and-i-don-t-know-1.4473035
- https://www.bbc.com/sport/rugby-union/55909328
- Rowan Stringer - DOI: 10.1017/cjn.2019.14
- https://www.frontiersin.org/articles/10.3389/fneur.2022.938163/full?utm_source=F-NTF&utm_medium=EMLX&utm_campaign=PRD_FEOPS_20170000_ARTICLE)
- https://journals.sagepub.com/doi/abs/10.1177/1941738120923869

## Key organisations for concussion in sport

| | |
|---|---|
| Concussion Legacy Foundation | Link |
| Danish Concussion Centre (in Danish) | Link |
| National Olympic Committee and Sports Confederation of Denmark (DNOC) | Link |
| UPMC Concussion Network | Link |
| Headway | Link |
| The Jeff Astle Foundation | Link |
| The Irish Concussion Research Centre (ICRC) | Link |

# Appendices

Co-funded by the Erasmus+ Programme of the European Union

## Appendix 1: Case Studies

### Sophie Spence:

**Former Irish Rugby Union player and current coach.**

See link for the Heads Up podcast with Sophie here:
https://lnns.co/2WPihQDjN5q


**Q: Did you experience concussion while you were playing either diagnosed or undiagnosed? What's your experience with it**?

**A:** I would have had concussion a couple of times while playing. The big one that was an issue for me was in 2016, just maybe second third club game into the season and we obviously had preseason and summer break and things. I was playing away against Bowes. I went in for a tackle and I got abit of a bang. Didn't really feel right. I came off the pitch when I came off I felt a bit sick but then I thought you know what I'm actually alright and then I went back on and went to make a tackle I hit my head off the other players thigh and I remember nothing after that I remember getting driven home it was just the strangest thing really because I wasn't physically sick or anything like that the medic said this is what this is what happened I tried to go through the return to play protocol and I think it was at the second stage I have to pull back I had to stop and rest again and obviously I was being monitored by the IRFU medical team.

I have passed the time I went to go again. I think maybe I got to the third stage that time and that was it and then had to rest and be pulled back again ended up having to go for an MRI.
The symptoms I had were terrible headaches I was doing is lying in bed every day it was a very hard period of time I found it really difficult because should missing training and knowing the other girls are still training trying to get myself ready for the autumn internationals which we're going to be played in UCD it was almost that I wasn't letting my body relax and get better. I was pushing myself too far thinking I was OK and that I would get better. It wasn't until the point where I spoke to the medic who told me 'No, you are out for the tournament' that I actually let my body recover. In December I still hadn't completed my return to play fully, so it was only January that I was starting to come through it. From that one concussion I was out for four months.

**Q: Do you those persistent symptoms and what sort of symptoms were predominant during that time?**

**A:** I think the biggest thing for me was the headaches. I went into work at one point thinking I could try to return to some normality even though I couldn't play rugby. When I went into work, I couldn't handle the noise or the light. I went home, and I was off work for about a month or even longer. I even remember trying to drive later and felt just fogginess. You are just kind of housebound really. The more Sophie talked about it, the more she remembered it all. From that point of view, I sense there was a bit of anxiety in you about your state at the time.

**Q: How were you emotionally at the time?**

**A:** It was a very emotional period of time I was in a different country from my mom and from my partner at the time. My social group and my stability were my friends on the team, and I couldn't even see them because of the injury. It's as if all my support networks were taken away from me. During this time, I would say I was very sensitive in a weird way. You are unsure when things are going to come right again, the thing is it's your head, you can't mess around with things like that. Even though you are putting pressure on yourself to get back you just can't it wasn't until I realized that that I could actually relax from that point of view, you are just mentioning the pressure.

**Q: Did you or did anybody that you played with may have stayed on playing when they possibly had a concussion or displayed concussion symptoms during a game or felt a responsibility to stay on even when they may have been experiencing concussive symptoms during playing?**

**A:** Yeah, probably. Not going to lie, it might not have been said, or you mightn't have known it until after, but I'd say like no one ever wants to come off, especially when playing at the highest level. When you are taken off you aren't happy about it. I suppose you can get a knock and not think anything of it and feel fine, but you could be actually concussed and it's later on that you start feeling symptoms, or you could completely black out. It's the different levels of reaction to it, and how symptomatic you are. Until someone says get off, very few people would take themselves off. You have worked so hard to that point, and I am not saying that's right, but you don't want to come off, and often have to be dragged off.

**Q: Where do you think we are in terms of our whole approach to concussion? Do you think we have gone really far to the right in terms of being over analytical? Do you think we are somewhere in the middle giving the right messages? Or do you think we have a long way to go?**

**A:** I think we are in a good space in that people are now aware of what concussion is and about the importance of what happens around it. It's that line of if you're an international athlete and you have a medical team that can fast track you through steps, in terms of you are being monitored day

by day. If you are a club player and you don't see a doctor and you have only access to a physio, are people monitored as well? Are they aware that they have to take a certain period of time off before they can start the return to play protocol? Do they actually know what the return to play steps are? I think when you are in a professional setting, you have the knowledge, or if you don't have the knowledge, people will guide you through that. I think it can be grey when you're in domestic games.

**Q: What are your impressions of the initial on field management in terms of identification and removal comparing your club experiences to your international experiences?**

**A:** International rugby you have paid doctors, paid physios. When you are playing a club game, you have someone who might just be helping out as a physio because they love rugby. Not to say that things aren't written up when someone has a concussion, but maybe someone didn't realise that they had a concussion, maybe they didn't see someone getting hit and didn't think they were concussed and then all of a sudden, they have been around for a week, and then they aren't feeling well, and they were concussed. You don't have tv screens on you, you don't have people looking out for those certain things. I think there is a huge difference between international and club rugby.

**Q: From your own background, what did you think the alignment was between coaching, medical and S&C staff across organisations that you were involved with? Especially in terms of the concussion protocols, return to play protocols?**

**A:** I have played under coaches where I have had injuries, and they pushed you to play through the injuries. In terms of concussion, I think it is a lot different. As a player, when it was that serious, and you are getting these symptoms, there is no way of hiding it. You get to the stage where you look into it and think about your symptoms more. It's different because it's not a physical injury, and sometimes you have to sit and wait to see what the next 24 or 48 hours bring. I think it's a different ball game when it comes to your head. I don't think people, not that I know of, are being forced back on the field with a concussion.

**Q: What are your thoughts around any long-term health effects or well-being effects from experiencing a number of concussions throughout your playing career?**

**A:** There definitely has to be long term effects. With physical injuries, there can be long-term effects, which can flare up as you age from time to time. With concussions, you wonder what's actually happening in your brain. There has to be something. Maybe your memory is not as quick, or you aren't as sharp, to other changes down the road around your short term and long-term memory

and how is that going to be affected. Is that only through the use of scans? I had an MRI to see where I was at, but I wouldn't be aware of what's on that scan or where that is, or if I could access it in case, I needed it in the future. Depending on what sport you are in, how professional it is and if you can keep your information, you wouldn't know really.

**Q: What are your thoughts on scrumcaps and gum shields in terms of reducing injury and concussion? And those risks?**

**A:** Scrum caps I played with one for about two or three seasons. After that I didn't bother. Have I been dropped in a line out? Yes! You try not to drop someone in a line out because you know how it can affect you. When you are in rucks, you try to cover your head in case a boot comes in and you try to prevent things as much as possible. There's something that can happen you don't realise it, making contact for example. How much would a scrumcap prevent that? I don't know. It's all dependent on forces. In terms of gum shields, it's always nice to protect the pearly whites and things, but that impact on the jaw. I definitely wouldn't play a match without a gum shield. Would I play a match without a scrum cap? Yes. In terms of prevention wise, I am not sure about all the percentages and things, but I suppose it's about the more areas you have of guarding yourself the better really.

**Q: If you were going to bring in a new rule or a new law in terms of how we could reduce injury risk around concussion, around head injury, is there anything we could do, in the women's game at this stage to try and reduce this risk do you think?**

**A:** I wouldn't be differing women's from the men's game. When you look at sport, ok, women might not be lifting 200kg on a squat, but someone could be lifting 150kg easily. Force on force, depending on collision wise, in the men's game, can be just a fierce in the women's game, but it's just different body types. In terms of changes, I don't know. When you're being coached, or you are a coach, it's about coaching things safely. I think that is the biggest thing around the tackle area, the breakdown area. If people aren't equipped to make a tackle or know what to do post tackle, or entering the gate appropriately in the breakdown, that's when things become dangerous. It's about coaching the game in the safest way possible and policing things. It's about not giving any grey areas to people about what's right or wrong. You see it in the Six Nations that aren't rugby such as players punching others, that boxing so go to a different sport. That creates things like concussion but unfortunately you are making contact in a tackle can also cause concussion, but it was probably from the previous thing, going into a ruck and bring hit on the head. It's difficult because that is the game, and if you

take things away, how many things can you take away and how many restrictions can you put in place?

**Q: From your own point of view, in terms of clubs and the long-term effects on retired players, do you think clubs or unions may have responsibility or do you think they should even be interfering in that space? If they were having long-term symptoms or long-term effects from concussion?**

**A:** It's hard because you look at insurance policies and they are not fit for purpose. Loss of limb or death that you are covered for. Would you actually want to play if you read that? When you are part of a club or part of a badge, you would like to feel that someone would be responsible for supporting you back. Depending on what form it is, when I was with Old Belvedere, coming into the club to leaving the club, from the director of rugby in the men's department, so many people were helpful in so many different ways, I think rugby is a sport which has great comradery. You would like to think that there was support there. I don't know how much you would get from any club, it's an interesting one isn't it? You look at NFL, and how much support people are getting for concussions and things, people who have ended up doing the extreme and taking their own lives post-concussion from the effects it has had on them. It's just about awareness for people and that people that are coming through the return to play protocols appropriately and if they have had too many concussions, you have to have a cut-off point. You get to a point where you wonder how some players are even playing sometimes. Surely someone has to take responsibility, and tell some players they have to retire, once they have had one too many concussions, but what is one too many?

## Laurie Ryan: Clare Ladies Gaelic Football Player

**Video is found YouTube - GAA Concussion Awareness with Laurie Ryan**

I didn't realise I had a concussion when it happened to me initially. I got a bang in the match, and I knew that I had to go off, that I didn't really feel okay. As the game went on, I started to feel a bit better. I drove home because I thought it was nothing at the time. When I got home, I was texting one of my friends and he told me that I was spelling all my words wrong, and I knew I had a bit of a problem then. The next day I thought I was fine, and I went to work. 3 days afterwards, I was walking up the stairs, and I got a bad headache and I started to get dizzy. And it was then I realized that I needed to go to a GP. The GP told me that I was concussed and that I needed to rest. I knew I needed to go to the specialist in Galway to figure out what was wrong with me and what I could do to start getting better. He was able to test me for all the different forms of concussion and guide me to a physiotherapist who I worked with continuously. The symptoms I suffered with my concussion were headaches, tiredness, dizziness, and lack of concentration. I also couldn't look at screens which really impacted my everyday life. A lot of exercises that I was doing to get better involved me moving my eyes. These were very easy exercises for anyone that wouldn't be concussed but I struggled every day that I had to do them. The moral of the story for me with concussion is don't let your symptoms go without getting checked. Concussion affects everyone differently and there isn't one set type so it's important that we all educate ourselves to recognize the symptoms.

Laurie was out for 3 months after she suffered her concussion. The key message both her, and the GAA stand by is 'If in doubt, Sit them out'

**Jerry Flannery: Former rugby player and coach with Ireland and Munster, current coach in the UK.**

**Interview from Heads Up Podcast with Ed Daly. See link here: https://lnns.co/-y0cK1Xmx9i**

**Q: If you were asked to describe a concussion to somebody, how would you describe it to somebody else?**

**A:** When you sustain a blow to the head or neck which shakes the brain and the damage that occurs there.

**Q: From your own point of view, were you ever diagnosed with concussion, or have you ever experienced one? Did you ever suspect that you were concussed, and it wasn't formally diagnosed?**

**A:** I was diagnosed with concussion; I think maybe 5 times in my career. There may have been a few others when I was not diagnosed but things are a lot different nowadays, from being in coaching now I see a much greater awareness of the symptoms of concussion and the dangers of concussion. The return to play protocols is far better and more adhered to than when I played. It's much safer because it is very dangerous.

**Q: From your own perspective you say you probably had 5 diagnosed concussions and another couple of ones you weren't too sure about. What type of symptoms did you experience from a personal point of view?**

**A:** I had some big ones, where I had a complete loss of memory. I think I may have received an undiagnosed one then a few weeks later where I got a bang on the head and then two weeks later played a game, a Munster Schools Trial match, I think I was 17 or 18. I think I just got a knee to the head; I don't have any memory of it. The following year, I got a couple of knocks on the head. One of them was a diagnosed concussion and that's when I would've been playing in UCC. I would have picked up a couple more over the course of my playing career, playing club and professional rugby. The symptoms were big. The ones that stood out for me were the ones where I had a loss of memory. I never actually suffered any symptoms afterwards. In return to play protocols, I never felt dizzy or ill or anything like that.

**Q: It's interesting because all concussions are unique, and people experience them differently. From the professional point of view, did you ever feel that you had a responsibility to return to the game even though you were partially symptomatic?**

**A:** No. I would always be keen to get back on the field because I enjoy the game, but I never felt that anyone was putting any pressure on me to go back playing when I had symptoms.

That's a good insight, because some studies would suggest that why a lot of people don't admit to having a concussion, they just want to keep playing.

**Q: From a concussion point of view, do you reckon that if you have one, you could be more prone to others?**

**A:** I am not qualified to speak on it, but from my experience, my first major concussion was a big one. One of the reasons maybe I didn't feel under pressure to go back playing was that my concussions were big ones where I had to be carried off the field and lost memory. It wasn't like people were unsure whether I had suffered a concussion or not. I think the first one which I mentioned was bad, but then two weeks later I got knocked unconscious.

**Q: From your own point of view, it may not necessarily have happened to you, but maybe someone you were playing with, did you ever experience anybody getting a concussion where it wasn't a direct blow to the head, or the neck. That it was somewhere else on the body?**

**A:** Most concussions that I witnessed were generally from a blow to the head or neck

From a symptom point of view, what's your take on that? How long did they last with you?

Like I said, maybe the five concussions that I had that were diagnosed, were all big and pretty clear cut, so there was never any doubt about the severity of them. I never rushed through the return to play protocols. I never really had any symptoms coming back, I would've had experience in Munster of some lads, when I was coaching there, some players might pick up a concussion or might be diagnosed with a concussion they mightn't have lost memory, but when they go back to try and go through some of the return to play protocols, then they would start experiencing headaches and they would immediately have to stop.

**Q: Did you ever have any brain imaging when you experienced your concussions? Or do you think those sorts of tests are useful to try and detect anything related to a concussion?**

**A:** I did have CT scans done a couple of times just to make sure everything was okay.

**Q: In terms of your own personal opinions around concussions, do you think we are over discussing it, in the middle of the road or is it something we need to have more conversation around?**

**A:** I think it's something that cannot be discussed enough. I think it's something that needs to be explored and we need to find out what else is going on, and what else we can do to make the game safer. I think that World Rugby is trying to adapt the game to make it sustainable to make it safer. I think there is a good awareness around it. Can it be better? Always could be better. It's on a journey now really, to see how far we can go because it's such a big issue that you can't afford to take it lightly. The more that we can find out about how the body reacts to concussion, how we can potentially mitigate that risk, I think it is well worth going through.

**Q: What was your impression of the initial on field management and identification of concussion? You were saying you were knocked out, that's very clear that you are out of the game, but do you think it's consistent across clubs? Do you think there's a good organisational alignment between coaching and medical staff?**

**A:** I can only speak for the clubs that I was involved with, as a player with Munster, Connacht, and as a coach with Munster. The risks are so great with concussion that they take a hard line on it and rightly so. I think that most would have an independent doctor at a lot of games who is going to be watching out for any potential head injuries. You have your own medics who will be watching for it too. Players too are aware about concussion these days, it's not a case of just getting on and playing with a head injury, I think players are aware that this is a lot different than a torn hamstring or a fractured ankle. This is dealing with the brain; the repercussions are far greater. I think that it's well organised, I think it can always get better, and I think it will get better. People are aware of the risks of concussion. I think if you look at the law changes brought in to try and make the game safer too, they have helped to reduce the risk of concussion. The better we can coach our young athletes in their tackle technique will be a big defining factor.

**Q: Do you think there are any long-term effects on health and wellbeing from multiple concussions?**

**A:** If you look at boxing and you see some of the boxers and you see some of their fine motor skills are reduced, and their speech is a little slurred after receiving a huge number of blows to the head. It's going to take more time and research that can back up that the blow to the head is what caused the slurred speech. There are papers on it, but I think there are obviously things you can do to reduce the risk, although rugby is an unpredictable game, there is going to be some level of head

injuries. It's about what else we can do to reduce the risks; whether its gum shields, head protection, scrum caps, improving players neck strength, will those things help? It's going to happen; it is a contact sport and it's unpredictable. Luckily enough, none of the people I have played with seem to have any long-term health problems from suffering concussions. I know some lads have retired because they received multiple concussions, but they don't seem to have any major issues now, which is positive.

**Q: Have you any insights, from being an ex-player and now a coach, are there any law changes that you think could be introduced to reduce injury risk? Is there anything we could do to maybe mitigate concussion risk?**

**A:** I am aware that the dynamic nature of rugby means a certain amount of this will take place. I think World Rugby is doing a reasonably good job. A lot of it is because you are going to have a lot of people who have been tackling a certain way for 15 years and then suddenly a law change comes in and they must change the way they tackle and that can be very difficult. If there is good technique being taught at underage level now, that's going to filter its way up. You would like to imagine that it is going to make a difference and make the game a lot safer. Because of the way the game is officiated now, it's rare that you see malicious fouls on the field that often. I think a lot of the time it is a head injury, or a high tackle a lot of it is down to poor technique, bad timing, and sometimes just bad luck. Hopefully over time that will keep decreasing as players' habits become engrained from underage levels when they first start playing the game and not just having to suddenly change their technique.

**Do you think coaches or club owners from a professional point of view, is there anything they could do from an injury risk point of view? Do you think they have a responsibility in that area?**

**A:** I think education is a big part of this and making sure there is transparency between the players, the coaches, and the owners. It's important to ensure that everyone understands the risks that are involved in concussions. I can understand from a coach or owners' point of view whether it's their investment in the club, with coaches wanting to get players on the field as quickly as possible for results. You really have to take a different approach when it comes to something like concussion because it's just something that you can't rush due to the potential detrimental effects if something goes wrong.

## Appendix 2: Survey Report

### "How to explain the invisible?"

The “How to explain the invisible?” survey was developed to aid the development of the "How to explain the invisible?" IO2 Training Guide. A training guide developed to equip VET (Vocational Education Trainers) educators with the knowledge and competencies required to deliver concussion specific training in amateur and community level sports across Europe. The survey comprised of three sections and was conducted using the Microsoft Forms platform from December 2020 to April 2021. Partners ATU (Atlantic Technological University), Galway (IRL), and OBU (Oxford Brookes University) (UK (United Kingdom)) analysed and produced the following data.

**Section 1 - Participants Demographics**

This section was designed to identify participants' demographic, gender, country of residence, their types of sport(s), and their role and level of involvement in said sports. There was a 100% (n=226) response rate in this section.

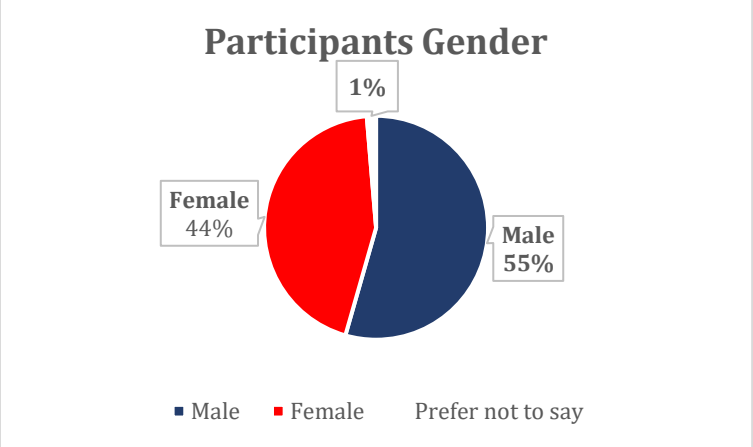


**Figure 1.1:** Participants were asked what gender they identified as, 44% of these identify as female (n=100), 55% identify as male (n=123) and 1% would prefer not to say (n=3).

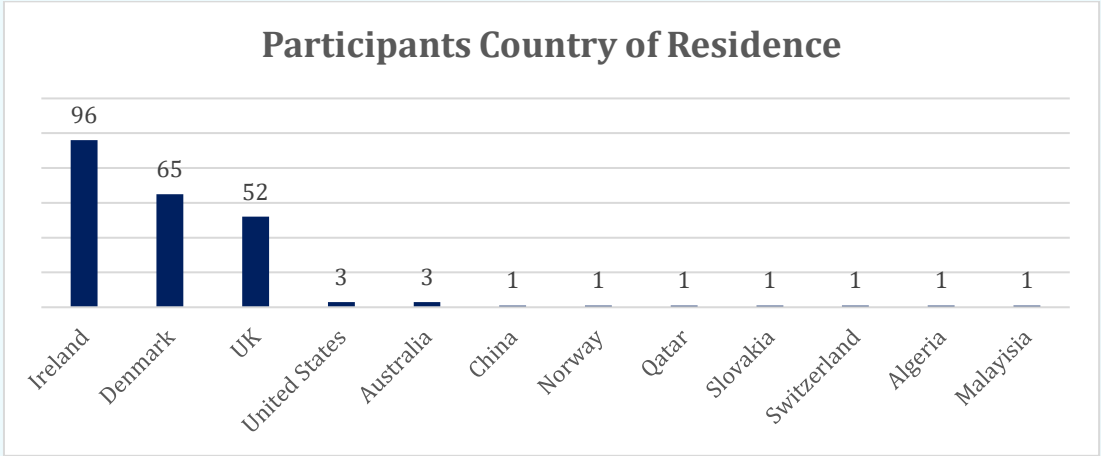


**Figure 1.2:** Participants were located worldwide, 42.5% were in Ireland (n=96), 29% in Denmark (n=65), 23% from the UK (n=52), 1.45% were in Australia (n=3), and the United

States (n=3), while 45% of participants were (n=1) from countries Malaysia, Algeria, China, Norway, Qatar, Slovakia, and Switzerland.

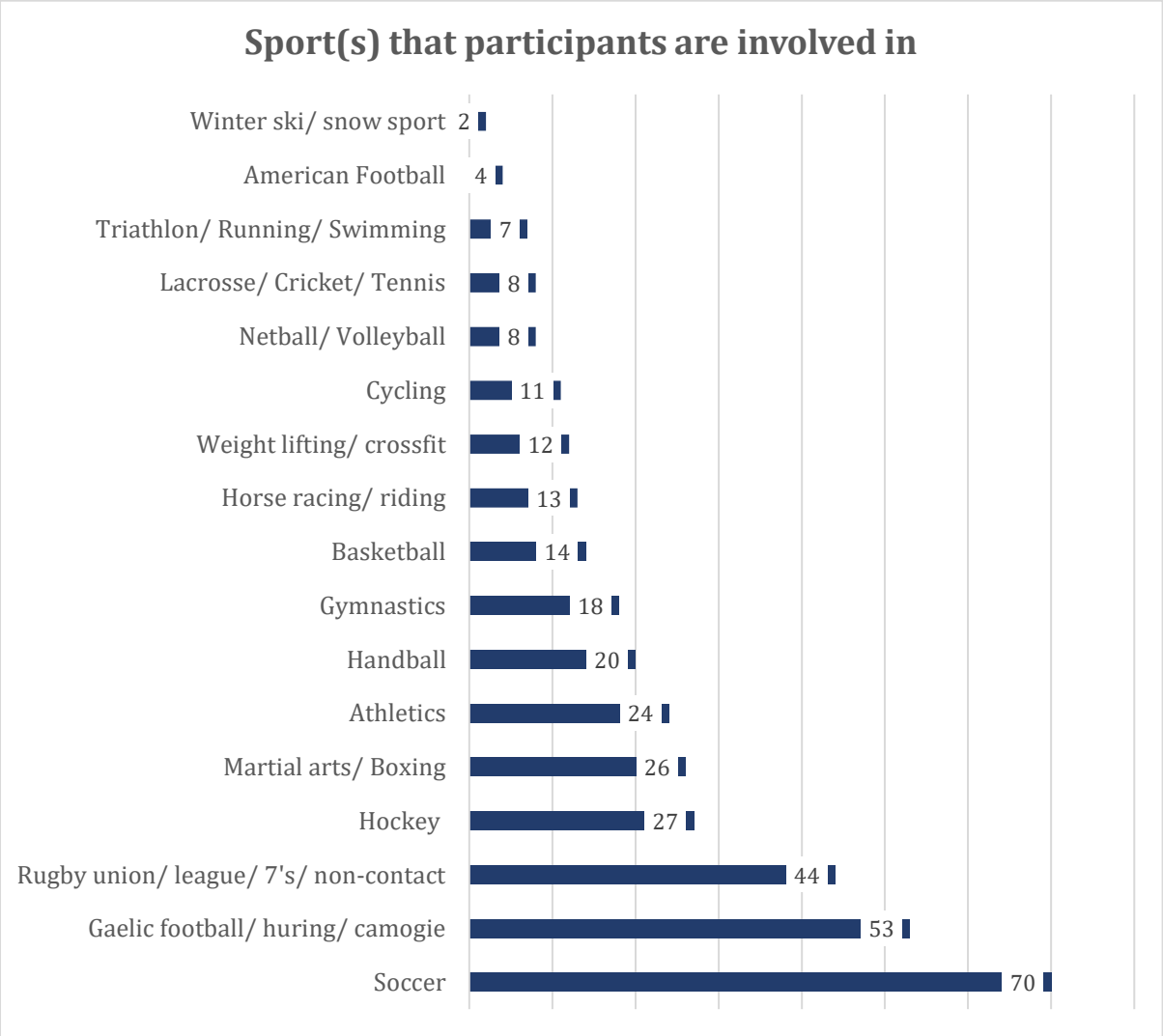


**Figure 1.3** Participants shared a large variety of sports they are involved in, with a majority choosing/ listing one or more diverse types.

The five most common sports were Soccer with 31% (n=70) involved, followed by 23% in Gaelic sports (n=53), 19% in Rugby (n=44), 12% Hockey (n=27), 11% Martial Arts/ Boxing (n=26) and 9% involved in Handball (n=20). These sports were followed by Athletics, Handball, Gymnastics, Basketball, Horse racing/ riding (including show jumping), Weightlifting/ Cross-fit, Cycling (including mountain, racing, and road), Netball, Lacrosse and Racket sports, Triathlon/ Running/ Swim and Winter sports.

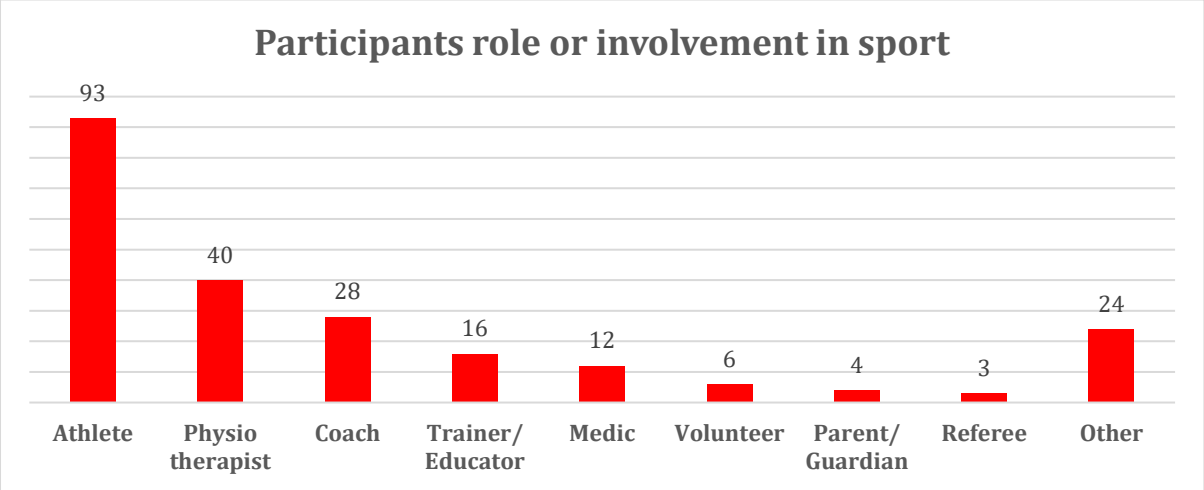


**Figure 1.4** Participants involvement in listed sports varied, with over 50% being athletes as well as being involved in another aspect of support in their sport. Athletes in total accounted for 41% of participants (n=93), 18% were physiotherapists (n=40), 12% were coaches (n=28), 7% were trainer/ educators (n=16), 5% put themselves in the medic category (n=12). While 3% selected volunteer (n=6), 2% were parents/guardians (n=4) 1.5% were referees (n=3).

For the rest of the sample, 11% chose other (n=24); these roles included Nutritionists, Chiropractors, Health and wellness officers, Performance and Board Directors, Personal Trainers, PhD Researchers, and support staff.

**Next section of the survey focused on** identifying participants' levels of teaching and coaching education, their experience with various levels and ages, and if they had experienced, witnessed, or been diagnosed with a concussion injury in said sports.


**Figure 1.5** All 100% of participants answered this question (n=226), 29% (n=65) selected 'yes' as they did have a formal teaching/ coaching qualification, while 71% (n=161) selected 'no' as they did not.

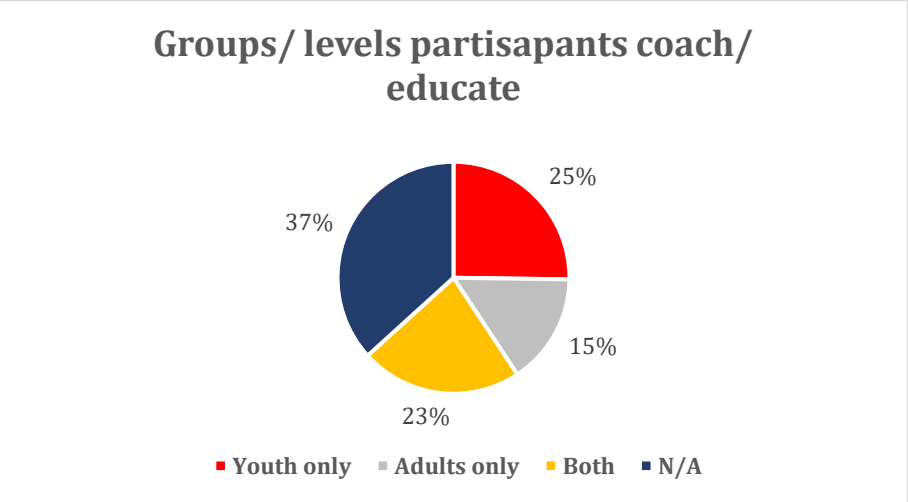


**Figure 1.6** Of all survey participants (n=226), 68% coach and educate various levels and age groups in sport, and 37% selected N/A (n=83) as they did not. Among those whom coach/educate, 25% work with youths only (n=57), 16% with adults only (n=35), and 23% with both groups (n=51).

Participants (n=83) were asked how long they had been involved in sport; 11% (n=9) skipped this question. The remaining 89% (n=74) of responses added up to 4016 years, with a mean of 19 years.

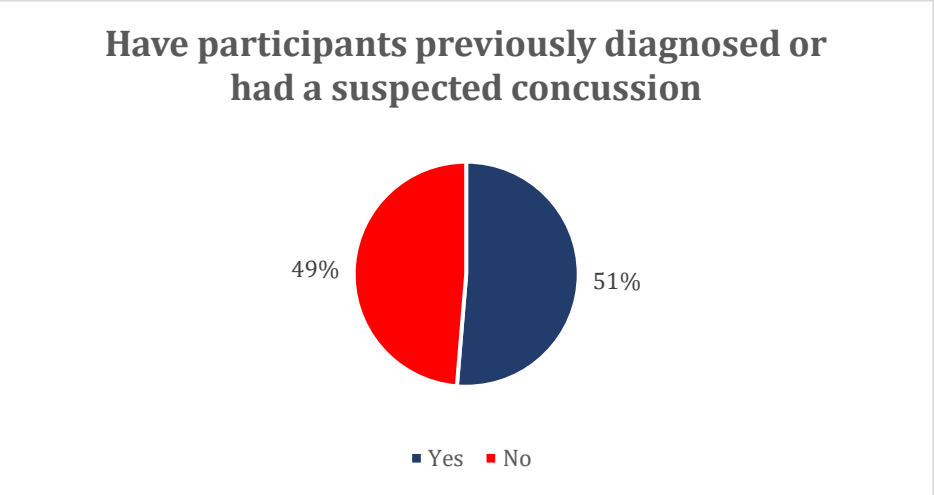


**Figure 1.7** Participants in Q8 (n=226) commented on if they had personally ever previously been diagnosed with or had a suspected concussion. Over half, 51% (n=116) chose 'yes', and 49% chose 'no' as they did not (n=110).

Of those that chose '**yes**' for having previously been diagnosed with or had a suspected concussion commented that they had experienced at least 2 concussions in their playing career.

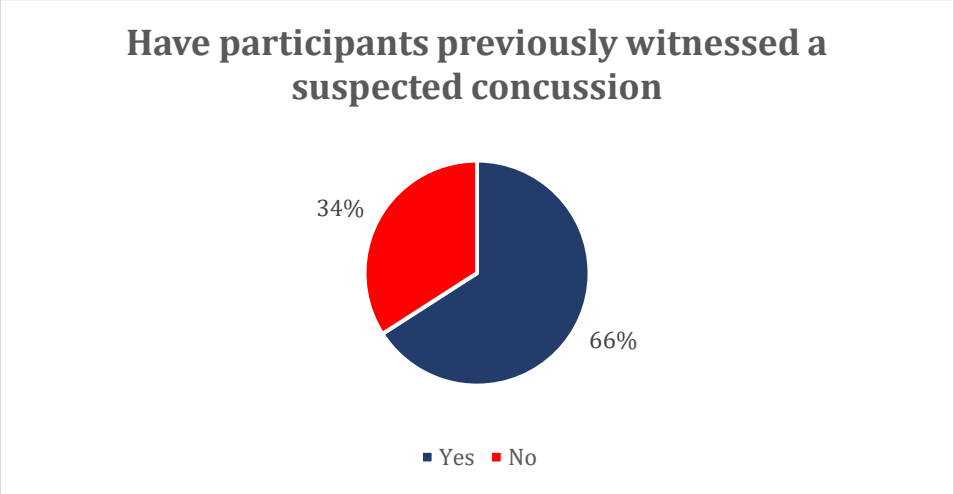


**Figure 1.8** Following on from Q8, participants were asked in Q9 if they had witnessed a suspected concussion in athletes they had played, worked with, or coached. There were 176 responses and 50 skips to this question**.** Of the participants that commented, 67% (n=116) did and selected 'yes', while 34% did not and (n=60) selected 'no'.

Participants who answered 'yes' (67%) for having witnessed a suspected concussion reflected a consensus and exclaimed they had witnessed multiple suspected concussions.

**Next section,** following on from identifying those that had sustained or witnessed, or been diagnosed with concussion injuries in said sports. The survey sought to identify if participants had taken part in concussion specific education, and their perceived level of knowledge on concussion injuries after education and training.

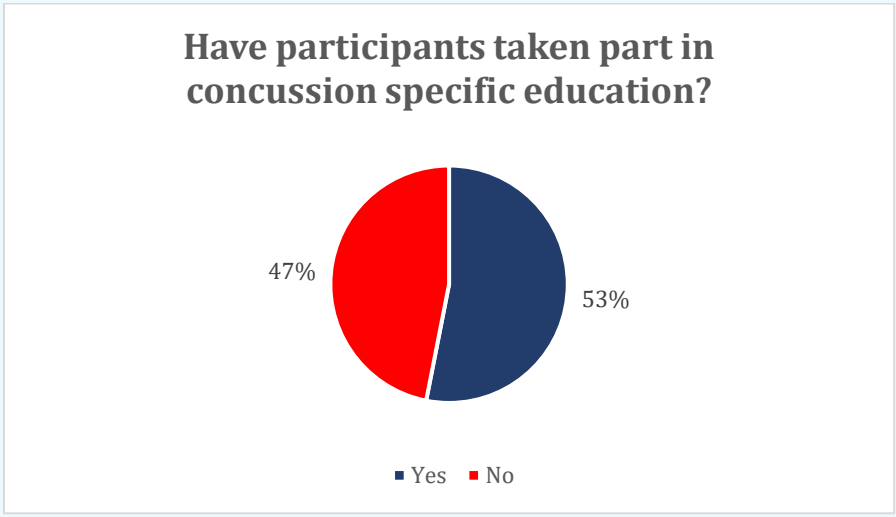


**Figure 1.9** There was a full response to this question (n=226); 53% chose 'yes' (n=120) as they have taken part in concussion specific training, while 47% (n=106) have not and chose 'no'.

Participants were asked to mention the type and duration of the concussion training they had taken part in. Answers ranged from World Rugby courses to local courses, referee courses, taught in education (masters, bachelors) and coaching courses.

**Training types ranged from:**

- Presentation organised locally by club/school
- Delivered by international/national sports governing body
- Part of formal learning (i.e., degree, MSc etc.).
- As part of coach/referee education
- Online training such as "Head's up" or "Headcase".
- Specific training, such as "Impact".
- First aid and advanced trauma courses.
- Engaged in academic research on concussion and associated conditions (i.e., CTE (Chronic Traumatic Encephalopathy)).
- Academic talks on concussion
- Teaching concussion education (i.e., as an academic or doctor)
- From being treated for concussions (i.e., advice from a doctor or health care professional).
- Informal education: i.e., reading online etc.

Individuals were asked to comment on who delivered the training they had taken part in and to mention the training provider.

The most common answers included:

- International/ national sports body (World rugby, international horse racing federation etc.)
- Universities
- First aid training provider (i.e., St John's).

Participants then commented on their level of confidence in relation to their knowledge on concussion injuries after taking part in education and training: **(1 = not confident, 3 = confident, 5 = very confident)** Participants average confidence score was 3.68 (146 responses)

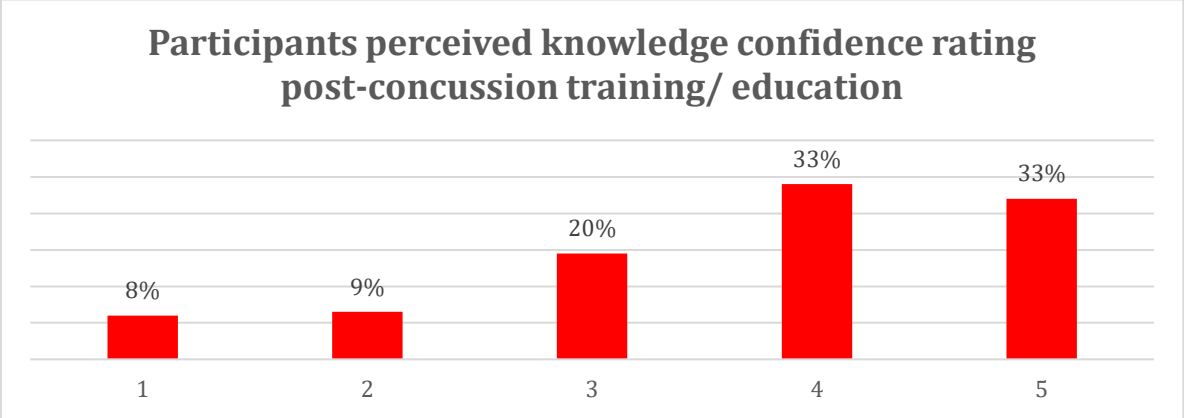


**Figure 1.10** Participants (65%, n=146) rated their level of confidence in their knowledge on concussion injuries after taking part in specific education and training. 30% felt very confident (n=48) choosing option 5, 33% (n=48) chose 4, 35% were confident (n=34) selecting option 3, while 9% (n=12) chose 2, and 8% selected 1 as they did not feel confident (n=12).

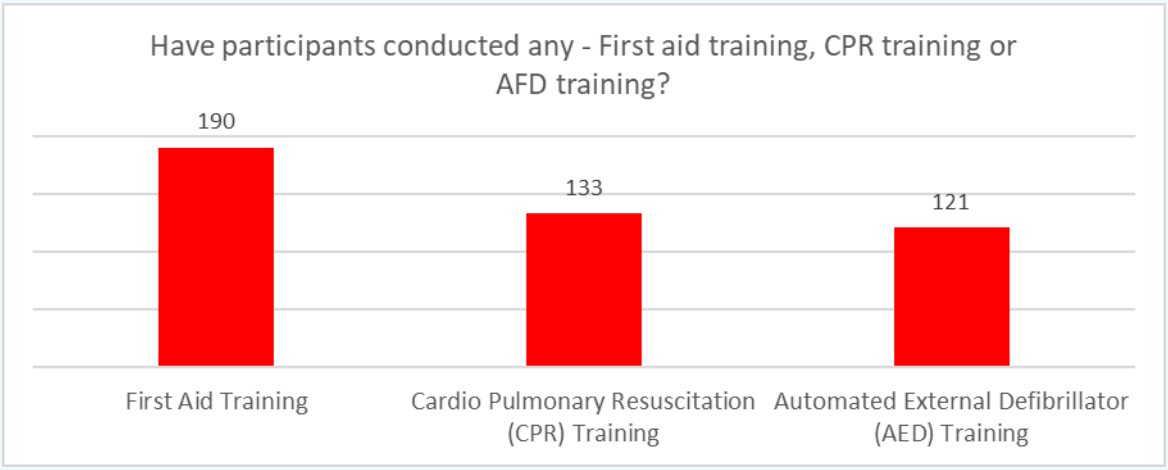


**Figure 1.11** All 226 participants answered this question, it was multiple choice and so there was a total of 444 responses, 43% (n=190) completed First aid training, 30% (n=133) CPR (Cardiopulmonary Resuscitation) training and 27% (n=121), and Automated External Defibrillator (AED) training. Additionally, 16% (n=71) took part in training relating to head trauma, 20% (n=89) in Medical, sport, health related science degrees (level 8) and it was not relevant for 7% (n=30).

**Question 16**

What topics in the list below would you deem important to consider in concussion?

The general consensus from **Question 16** was that all topics named in the list (Signs & Symptoms of concussion, Return-to-play guidelines, Long-term health consequences, Management of concussion, Assessment diagnosis and identification of concussion, Post-concussion syndrome, General information, Risk factors for concussion, How concussions are obtained, Long-term health consequence) are very important and should be taught for concussion education, although some individuals felt that depending on who you were educating that some topics may be deemed more important than others.

**Section 2**

**Concussion Knowledge and Attitudes**

Participants were asked to read several statements/questions and select TRUE or FALSE based on their knowledge without looking up answers. This was to test to try to identify respondents' true knowledge of concussion during the time of survey participation.

| **Concussion Knowledge and Attitudes** | | |
|---|---|---|
| 17. There is a possible risk of death if a second concussion occurs before the first one has healed. | 162 | 64 |
| 19. People who have had one concussion are more likely to have another concussion. | 147 | 78 |
| 20. In order to be diagnosed with a concussion, you have to be knocked out. | 3 | 221 |
| 21. A concussion can only occur if there is a direct hit to the head. | 36 | 190 |
| 22. Being knocked unconscious always causes permanent damage to the brain | 28 | 198 |
| 23. Symptoms of a concussion can last for several weeks or longer. | 222 | 4 |
| 24. Sometimes a second concussion can help a person remember things that were forgotten after the first concussion | 29 | 195 |
| 26 After a concussion occurs, brain imaging (CAT Scan, MRI, X-Ray, etc.) typically shows visible physical damage (e.g., bruise, blood clot) to the brain. | 102 | 122 |
| 27. If you receive one concussion and you have never had a concussion before, you will become less intelligent. | 3 | 222 |
| 28. After 10 days, symptoms of concussion are usually completely gone. | 97 | 127 |
| 29. After a concussion, people can forget who they are and not recognise others but be perfect in every other way. | 142 | 79 |
| 30. Concussion can sometimes lead to emotional disruptions. | 217 | 9 |
| 31. An athlete who gets knocked out after getting a concussion is experiencing a coma. | 29 | 197 |
| 32. There is rarely a risk to long-term health and well-being from multiple concussions. | 39 | 186 |
| Would you be interested to participate in further research on concussion? | 175 | 52 |

**Section 3**

**To evaluate participants interest and need for future education and training in concussion**

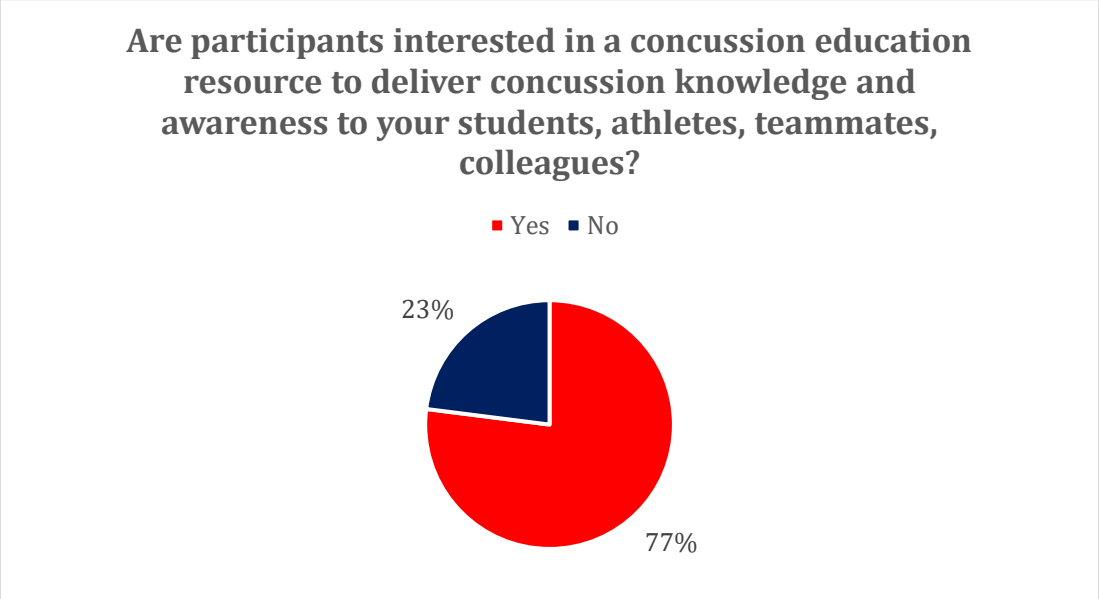


**Figure 1.28** There were 126 respondents that voiced their interest in a concussion education resource of those 90% (n=200) selected 'yes' while 6% (n=13) selected 'no' and 5% (n=11) chose the other option.

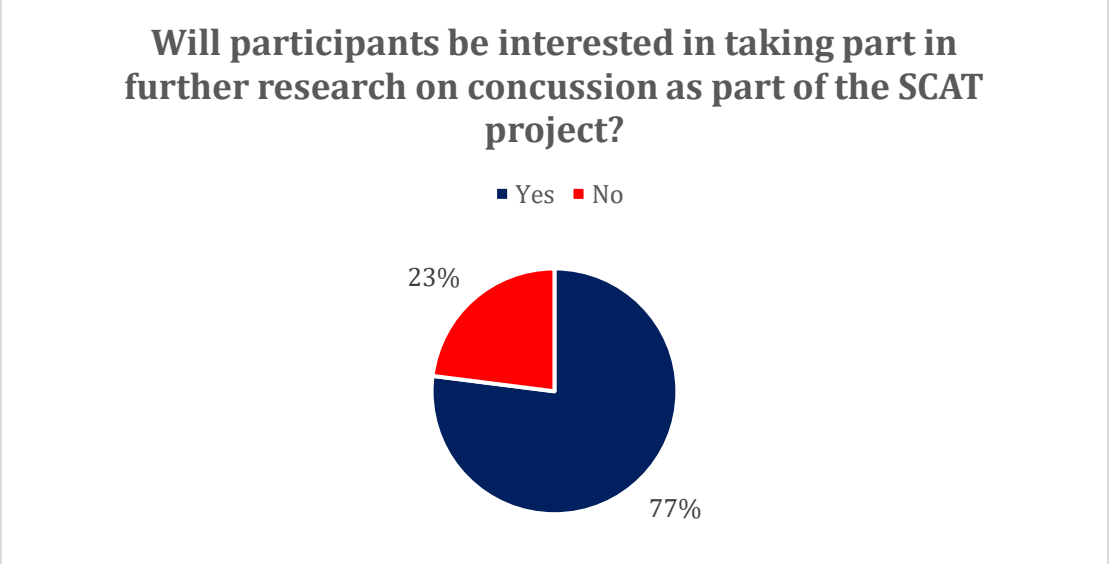


**Figure 1.29** In the final question, of all 226 participants who answered,77% (n=174) responded yes and would like to participate in further research, while 23% (n=52) answered no.