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Bhaile Átha Cliath
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Is Metacognition a Forgotten Facet in Athletic Therapy Education?

Lynn Allen, BSc, MSc, PgDip, CAT

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Student Declaration

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I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of DProf Elite is entirely my own work, and that I have exercised reasonable care to ensure that the work is original and have conformed to the regulations on the use and declaration of Generative AI, and does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work. I hereby certify that no Generative Artificial Intelligence (Gen AI) tools have been used in the creation of the thesis.

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Glossary of Abbreviations

ARTI	Athletic Rehabilitation Therapy Ireland
MAI	Metacognitive Awareness Inventory
SPSS	Statistical Product Service Solutions
TESQ	Total Educators Self-Reflective Questions
TIMP	Total Implementation Metacognitive Teaching Practices
TKC	Total Knowledge of Cognition
TMAI	Total Metacognitive Awareness Inventory
TRC	Total Regulation of Cognition
VLE	Virtual Learning Environment

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Dedication

This thesis is dedicated to my husband, Daniel, and my sons, Joshua and James.

Daniel, over the past seventeen years together, you have been my rock and there are no words to describe what a patient, loving and kind-hearted man you are! Although, I may have written this thesis, you have travelled every part of this journey with me. In particular, taking over the majority of the childcare duties to allow me to complete this thesis, for which I am incredibly thankful. Without your love, support, understanding and constant encouragement, I wouldn't have been able to do this, without you by my side. Words cannot express my love to you.

Joshua and James, my amazing sons, of which I love and treasure so much, you mean more than words can ever describe! May you always know how deeply loved you are. I look forward to having lots of adventures with you both and Daniel, by my side.

Faith, hope and love, and the greatest of these is love.

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Abstract

Is Metacognition a Forgotten Facet in Athletic Therapy Education?

Author: Lynn Allen BSc, MSc, PGDip, CAT

Introduction: Metacognition is the theoretical framework used for enhancing higher order cognitive skills, often referred to as "thinking about thinking". However, research in metacognition has been limited in higher education and is lacking in athletic therapy education.

Aims: The aim of this research was to explore Irish athletic therapy students' and educators' awareness of metacognition and its implementation into educational practice, underpinned by a pragmatic research approach.

Methods: Critical appraisal of the literature surrounding the role of metacognition in enhancing clinical reasoning skills in athletic therapy was examined. Following this, Irish athletic therapy undergraduate students (n=233) completed a cross-sectional questionnaire, including the 52-item Metacognitive Awareness Inventory. A mixed-method approach was then used to examine allied healthcare educators' awareness, understanding and inclusion of metacognition in their teaching practice, utilising a questionnaire (n=28) and semi-structured interviews (n=14). Finally, the exploration of barriers and facilitators to implementing metacognitive teaching strategies in allied healthcare education was examined by semi-structured interviews (n=14), using a reflective thematic analysis approach. Recommendations based on the findings were devised and were peer evaluated.

Results: Irish athletic therapy students demonstrated moderately good metacognitive awareness across the four years of their undergraduate programmes. Two-thirds of allied healthcare educators had heard of metacognition; however, their understanding of metacognition was quite varied. During the semi-structured interviews regarding the inclusion of metacognition into educational practice, themes such as key contributors, contextual and pedagogical considerations, types of metacognitive strategies and the role of metacognition were identified. Many of the barriers to the implementation of metacognitive teaching strategies into athletic therapy education, including a lack of metacognitive knowledge, time, student engagement and educational constraints, could be overcome by facilitators, such as enhancing the promotion of metacognition, student ownership and responsibility and faculty development. Recommendations from the research findings included the creation of a 5E best practice conceptual framework for educators to facilitate the successful adoption of metacognition into athletic therapy education.

Conclusion: Despite the evidence on metacognition and its benefits for academic performance and learning, much work remains to embed this theoretical framework into athletic therapy education. This can be achieved by enhancing students', educators' and higher education key contributors' knowledge and awareness of metacognition through professional development and embedding it into classroom teaching practices and curricula.

Chapter 1. Introduction

Chapter 1: Introduction

1.1.Establishing context

Athletic therapy is a global allied healthcare profession that specialises in the prevention, assessment, diagnosis, treatment, rehabilitation and management of neuromusculoskeletal injuries and illnesses (Frank et al., 2019). Over 70,000 athletic therapists globally work in a diverse range of employment settings, such as elite and recreational sports, occupational and industrial settings, military, universities, high schools, hospitals and private practice (Harris et al., 2024). In Ireland, athletic therapy is a relatively new profession formed, in 2009. Athletic Rehabilitation Therapy Ireland (ARTI) is the governing and regulatory body for certified athletic therapists. In Ireland, there are three ARTI-accredited programmes that offer a four-year undergraduate honours degree in athletic therapy. All three programmes embed theoretical knowledge with hands-on practical experience and clinical exposure throughout the four years of training. A particular emphasis is placed on students undertaking a semester-long immersive placement in year four, with the requirement to complete a minimum of 500 hours in clinical and field-based settings. Therefore, all three programmes must achieve specific educational competencies to maintain accreditation which standardises and unites the profession in Ireland and globally with partners in Canada, the United States of America, and the United Kingdom.

Athletic therapy clinical practice and education is centred on the accumulation and integration of clinicians' knowledge, skills and experience (Geisler & Lazenby, 2009; Koufidis et al., 2020). Ultimately, an athletic therapy graduate should be able to "think critically and reason clinically" (Barrett et al., 2018 p.360). Clinical reasoning is a complex cognitive process used to identify pertinent clinical information from a clinical encounter with a patient, and to

make the most successful diagnostic, therapeutic, prognostic and management decisions regarding the patient's clinical presentation and context (Daniel et al., 2019; Yazdani & Abardeh, 2019; Young et al., 2018, 2020). Therefore, the development of clinical reasoning is a fundamental core competency in athletic therapy education (Hofmann et al., 2022; Lafave et al., 2021). It is important to clinicians, educators, and particularly students, as they are the clinicians of tomorrow (Geisler, 2016).

Although clinical reasoning is central to medical and healthcare educational practice, it is perceived as a challenging and poorly understood concept (Richards et al., 2020). Consequently, it can be challenging for educators to effectively teach students clinical reasoning skills. The changing and differing demands from an ever-evolving healthcare landscape (Khanna et al., 2021) requires educators to be adaptive in their teaching practice that connects the classroom and the clinical setting more coherently. This will assist in preparing students to become competent in all clinical encounters. Teaching clinical reasoning should become the theoretical fulcrum on which educational programmes base their clinical and experiential learning (Geisler & Lazenby, 2009). However, a challenge remains for educators; do athletic therapy programmes teach students how to think like clinicians or do they simply teach them the knowledge and mechanics of athletic therapy? (Geisler & Lazenby, 2009).

The transition to higher education requires students to become more independent learners (Dennis & Somerville, 2022). However, the senior cycle within secondary school education in Ireland still encourages rote learning techniques for students to study for examinations (Gleeson, 2024). Higher education is shifting its focus from traditional, didactic, passive learning to more student-centred, active, participatory learning that enables students greater autonomy and ownership of their learning (Chan & Lee, 2021). For successful learning to occur, regardless of educational level, knowledge should not be crammed, students should

plan out their study, test their knowledge and identify and remediate any knowledge gaps, which promotes long-term retention of information (Kosior et al., 2019). In other words, students should be metacognitively aware. Metacognition is defined as "thinking about thinking" (Schraw, 1998; Schraw & Dennison, 1994). Metacognition provides a thinking infrastructure for students to identify what they do know, what they do not know and seek ways to remediate this by directing, monitoring, regulating, organising, and planning their thinking and learning, ultimately enhancing performance (Abdelrahman, 2020; Rivas et al., 2022). "Thinking drives doing, and doing can only be improved and progressed by thinking" (Geisler & Lazenby, 2009 p.54). Therefore, educators have a responsibility to educate and help students augment their metacognitive thinking skills which can be improved through explicit instructional or metacognitive teaching strategies (Schraw, 1998).

Fewer accomplishments in life appear more significant than individuals being cognisant of their own thinking processes, being able to reflect, monitor and manage their thinking which is helpful in both personal and professional situations (Kuhn, 2000). Yet, despite this, few students know how to be metacognitively aware, whereby they can effectively and efficiently learn, be independent self-regulated learners, and be capable of establishing clear and effective goal setting and study strategies. This will improve both their academic performance and clinical performance (Zimmerman, 2002), positively influencing patient care. The goal for educators is that students are equipped and encouraged to think like experts as early as possible in their undergraduate training (Zagury-Orly et al., 2022). A proposed key to this solution is the enhancement of students' metacognitive thinking skills infrastructure (Geisler, 2016). Therefore, educators have a responsibility to support students' learning by enhancing their thinking skills which will ultimately impact their clinical reasoning and patient care.

1.2.Biographical positioning

I have been an athletic therapy educator, programme director and placement coordinator in the Technological University of the Shannon, Athlone, for the duration of my professional doctorate studies. I have taught across all 4 years of the undergraduate athletic therapy programme, from the delivery of theoretical modular content to the practical hands-on skills needed to be a competent and highly skilled athletic therapist. Over the years, I have witnessed first-hand how many students struggled to clinically reason effectively and efficiently. This became particularly apparent during the pandemic when we had to change our teaching approaches from face-to-face delivery to online and blended-learning instantaneously, without preparation of educators or students for this significant change in learning. As a result, I wanted to understand more of the theoretical underpinnings of clinical reasoning that could better inform my teaching practice, and thus improve the clinical reasoning of my students, the future clinicians of this profession. This stems from my personal desire to create a teaching and learning environment that is student-centred and supports students along their educational pathway in developing a passion for healthcare that seeks to help others.

Clinical exposure and placement play a significant role in developing students' clinical reasoning skills. From my experience of observing and examining students in clinical examinations, their clinical reasoning ability tends to increase over time, with a particular increase noted when they return from an entire semester of clinical immersive placement in Year 4. When I asked students at the end of year 4 about the programme, many confirmed that their clinical reasoning just "clicked" during their time on placement. Through daily clinical encounter exposures with patients during students' clinical immersive placements, it provides students with a great opportunity to put their learning into action and apply their theoretical knowledge into practice. Therefore, knowledge and skills learned in one situation become the

instruments of understanding and change for other situations (Dewey, 1938). As educators, we need to be cognisant of scaffolding learning that better prepares students for this everyday encounter. This motivated me to find out more about clinical reasoning, why this may happen and seek ways to improve my teaching to aid students' learning. A primary responsibility of educators is the ability to create learning experiences that are conducive to student growth (Dewey, 1938; Richardson et al., 2021), which is something I strive to achieve with my students.

Within the athletic therapy profession worldwide, lifelong learning is viewed as a foundational behaviour to help advance the profession, where metacognition significantly contributes to this lifelong learning. Lafave et al. (2021) stated that athletic therapists should possess scholarly attributes, through a demonstration of a lifelong commitment to continuous learning, teaching others and excellence in practice. Dewey (1938) stated "the most important attitude that can be formed is that of desire to go on learning."(p.48) This deeply resonates with me, as I strive to create supportive learning environments that stimulate and encourage students to excel in their learning and maintain a lifelong commitment to furthering their learning.

Mid-way through my programme of study, I became the President of ARTI, which is the governing body responsible for the advocacy, promotion and continuing education of certified athletic therapists in Ireland. This new role has provided me with an additional perspective on athletic therapy education and the fundamental role that metacognition plays in clinical reasoning, involving all key contributors; students, educators, clinicians and preceptors alike. As president of ARTI, my leadership and engagement with members, accredited universities and educators, and other professional and regulatory bodies, nationally and internationally has provided me with a greater overarching understanding and vision of athletic therapy education and practice. In my experience, clinical reasoning and metacognition

transcends across all educational contexts, irrespective of where in the world athletic therapists are educated or practice. As a strong advocate of translatability of research into practice, it soon became apparent after attending stimulus presentations on metacognition (at the early stage of my studies), that metacognition was fundamental to the development of student's clinical reasoning skills. Metacognition allows students to develop more expert-like thinking that aids in the "clicking" of their clinical reasoning during clinical encounters. It also resonated with me as a framework to support student learning and to advance these fundamental metacognitive thinking skills, as they have the potential to enhance students' and graduates' clinical performance and lifelong learning.

1.3 Aims and Objectives

Based on the need to better understand and explore the role of metacognition in athletic therapy higher education in Ireland from both the students' and educators' perceptive, the aims of this research were:

1. To examine the role of metacognition in enhancing clinical reasoning in the healthcare profession of athletic therapy.
2. To examine metacognitive awareness in undergraduate athletic therapy students.
3. To explore allied healthcare educators' awareness, understanding, and inclusion of metacognition in their teaching practice.
4. To explore the barriers to and facilitators to the implementation of metacognitive teaching strategies in allied healthcare education.

Objectives:

1. To provide practical recommendations for the promotion of metacognition in athletic therapy education.

2. To identify whether year of study, completion of immersive clinical placement experiences, or gender impacts athletic therapy students' metacognitive awareness.
3. To understand how educators' knowledge and awareness of metacognition influenced their implementation of metacognitive teaching strategies in their teaching practice.
4. To identify the barriers and facilitators of implementing metacognitive teaching strategies in allied healthcare education.

1.4 Programme of work

This research explored the role of metacognition in athletic therapy education. Chapter 2 reviews the current literature pertaining to clinical reasoning and metacognitive skills and best practice teaching strategies to embed these critical cognitive skills into undergraduate allied healthcare education. This chapter provides a theoretical underpinning for the practical applications of metacognitive teaching strategies and the importance of these skills for lifelong learning. Chapter 3 presents my research philosophy and methodological design of the programme of study. Chapter 4 quantitatively assesses athletic therapy students' metacognitive awareness using the Metacognitive Awareness Inventory (MAI). This also establishes if year of study, completion of immersive clinical placement experiences, or gender impacts athletic therapy students' metacognitive awareness. Chapter 5 employs a mixed-method approach to examine educators' awareness, knowledge and inclusion of metacognitive teaching strategies, while Chapter 6 qualitatively examines the barriers and facilitators to embedding metacognitive strategies into athletic therapy education. Chapter 7 provides a framework for educators for the successful adoption of metacognition into athletic therapy education, offering practical recommendations and applications on how best to achieve this. In particular, this chapter offers a sample professional development training programme for educators in metacognitive

teaching practices. Finally, Chapter 8 details a general discussion on the findings of the main empirical studies of the thesis, limitations, future direction of research in this area and concluding remarks.

Chapter 2. Literature Review

Chapter 2: Literature Review

2.1 Introduction

In this literature review, a critical analysis of the literature pertaining to the importance and development of clinical reasoning and metacognition will be conducted, in the context of higher education and in particular, athletic therapy education. Following this, a critical appraisal of the literature examining metacognitive awareness of students and educators and the role educators play in the development of this awareness will be conducted. In order to improve the development of metacognitive awareness, the literature review will examine different metacognitive teaching strategies used in higher education. This will be set against cultural and environmental considerations, including resources and support for the successful implementation of metacognition into athletic therapy education. This review will demonstrate the interrelatedness and interdependence of both clinical reasoning and metacognition in the development of future clinicians in allied healthcare and athletic therapy. In this literature review, a paper which has been accepted for publication, entitled “Promoting metacognitive strategies to aid clinical reasoning skills: a case study in athletic therapy/training” forms the basis for this review of literature, as shown in Appendix A1.

2.2 Clinical Reasoning in Allied Healthcare

Clinical reasoning is a complex, nuanced, multifactorial cognitive process inclusive of clinical judgements, decision making, and problem-solving that enable clinicians to integrate and utilise different types of knowledge, critical appraisal, reflection and metacognition, for the evaluation and management of patients (Geisler & Lazenby, 2009; Gordon et al., 2022; Yazdani & Abardeh, 2019). Clinical reasoning is fundamental to clinical practice and a core

component of being a healthcare professional (Norman, 2005; Young et al., 2019). It is an iterative and reflective process that is central to effective patient care, inclusive of cognitive, affective and psychomotor skills (Huhn et al., 2019; McDevitt et al., 2019; Newsom et al., 2022).

2.2.1 Defining clinical reasoning

Despite the essential role clinical reasoning plays in healthcare globally, it lacks a formal definition. With little consensus on the basic characteristics of clinical reasoning, there are issues with examining it and recommending the best practices for teaching clinical reasoning (Daniel et al., 2019; Norman, 2005). This is evident in the Young et al. (2020) scoping review of clinical reasoning in healthcare professions, whereby 625 papers were identified and a total of 110 varying terms were used to describe and define clinical reasoning. Of the 625 articles reviewed, the vast majority of papers analysed were from medicine (53.6%) and nursing (30%). In contrast, physical therapy/physiotherapy accounted for 2.9%, 2.6% were related to occupational therapy and athletic therapy/training was not mentioned. The large number of terms used to conceptualise clinical reasoning has resulted in much confusion, disparity and fragmentation of the literature (Koufidis et al., 2020; Young et al., 2018). Five of the most commonly used terms to describe clinical reasoning as categorised by Young et al. (2019) were decision-making, critical thinking, problem-solving, clinical judgement and diagnostic reasoning. Confusion can especially occur when these terms are used interchangeably (Kosior et al., 2019), but the meaning and interpretation may differ depending on the context, such as in teaching or the assessment of clinical reasoning (Gordon et al., 2022; Young et al., 2019).

Critical thinking is viewed as analysing, evaluating and interpreting information (Barrett et al., 2018), is not domain-specific and can be used in all professional capacities. Whereas, clinical reasoning is healthcare-specific, integrating clinical evidence and experience. Nonetheless, critical thinking forms an important component of the clinical reasoning umbrella (Newsom et al., 2022). Currently, no one single theory or concept has accounted for all aspects of clinical reasoning. With this in mind, Geisler (2022) categorised clinical reasoning in athletic therapy into three main components, namely: diagnostic reasoning, contextual reasoning and therapeutic reasoning.

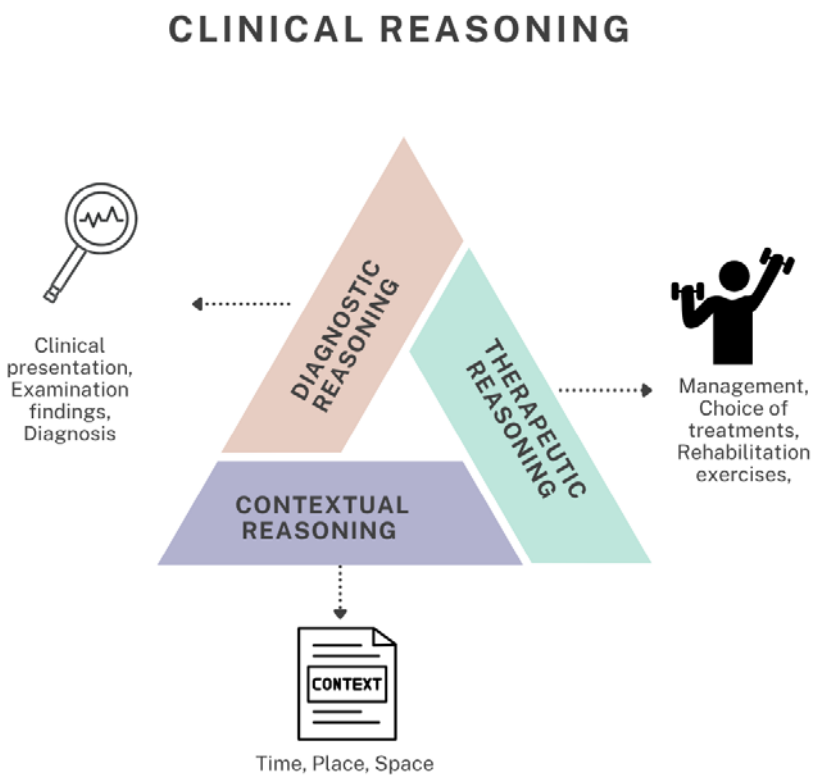

Figure 2.1 Clinical Reasoning Components

Diagnostic reasoning is arguably the most important skill a clinician can possess (Croskerry, 2009). It is the ability to classify a constellation of symptoms, examination findings and test results (Cook et al., 2018). Providing patients with an accurate diagnosis continues to be a challenge faced by healthcare professionals (Trowbridge & Olson, 2018). However, sometimes students, educators and clinicians alike have a preoccupation about getting the "right" diagnosis rather than understanding the many variables at play during a clinical encounter (Gruppen, 2017). Hence, clinical reasoning becomes centred around a definite and correct diagnosis instead of appreciating and understanding the complex cognitive processes at play during clinical reasoning. All diagnostic reasoning occurs in highly contextualised environments (Trowbridge & Olson, 2018), where the deep meaning of a clinical sign or symptom is never understood in isolation, hence, context is essential (Bordage & Lemieux, 1991).

Contextual reasoning is the weaving together of the patients' clinical problem in the clinical environment, whereby this clinical interaction creates meaning and context during the clinical encounter (Durning et al., 2012). Contextual reasoning plays an important role in the patients' clinical presentation as it relates to the patient's circumstances, preferences and environmental factors (Daniel et al., 2019; Koufidis et al., 2020; McBee et al., 2018). Similarly, contextual reasoning is the interaction of time, place and space (Geisler, 2022). Clinical reasoning is context-dependent and context-specific (Gruppen, 2017; Koufidis et al., 2022), through the integration of knowledge with contextual factors to individual situations allowing clinicians to arrive at diagnostic and therapeutic solutions (Koufidis et al., 2020).

The clinical learning environment is dynamic and multi-layered where integrating contextual understanding into teaching, assessment and evaluation better reflects the healthcare complexities evident in today's world (Ward & Diug, 2022). Competence in clinical reasoning

is contextual due to the interplay of many factors such as the skill to perform the task, but also how clinicians think through the clinical task which significantly contributes to patient care (Teunissen et al., 2021). “Expert clinical reasoning is a consequence of an extensive and multidimensional knowledge base” (Norman, 2005 p.423), hence adaptability and contextual factors must be taken in account for sound and robust clinical reasoning (Bleakley, 2021).

Therapeutic or management reasoning examines the clinical decision-making processes clinicians make regarding patient’s management, choice of treatment, rehabilitative exercises, follow up visits, or additional testing needed (Cook et al., 2018). This is an area in literature which remains scantily researched in comparison to diagnostic reasoning (Gruppen, 2017). In addition, therapeutic or management reasoning is arguably more important than diagnostic reasoning as clinicians frequently manage patients’ symptoms and treatment, before a definite diagnosis is provided (Von Hoyer et al., 2022). Therapeutic or management reasoning requires clinicians to plan, prioritise, monitor, evaluate and reflect on patients’ progress during each patient encounter (Cook et al., 2018), utilising higher order or metacognitive skills to do this effectively and efficiently. Therapeutic or management reasoning is more difficult to examine in the literature, as it is highly individualised and contextual to the individual’s needs and preferences in comparison to diagnostic reasoning, which is more generalised to constructing a medical label or diagnosis for the patient (McBee et al., 2018). Despite this, all three components of clinical reasoning, namely diagnostic, contextual, and therapeutic are of the utmost importance in better understanding, teaching and assessing this critical core competency in healthcare.

2.2.2 Theoretical underpinnings of clinical reasoning

There are two main theories of how clinicians and students apply their clinical reasoning skills during clinical encounters: 1) Case pattern recognition and 2) Hypothetico-deductive reasoning. Case pattern recognition is intuitive, relying on mental shortcuts or heuristics, allowing decisions to be made quickly, with minimal cognitive effort (Norman et al., 2017). This results in rapid recognition of clinical patterns from limited data, also known as illness scripts or schemas based on previous knowledge and experience, stored in the long-term memory (Croskerry, 2009; Kump et al., 2015; Pelaccia et al., 2020; Richards et al., 2020). For example, patterns, such as signs and symptoms and mechanisms of injury, are typically recalled (Geisler & Lazenby, 2009; Koufidis et al., 2020). More experienced clinicians typically use case pattern recognition, using more encapsulated knowledge from their past contextual experiences and intuition to make a clinical diagnosis (Elstein, 2009; Geisler & Lazenby, 2009). Some of the characteristics of case pattern recognition include: non-analytical reasoning, deductive, organised, intuitive, utilising key feature patterns and differential diagnoses which results in fast conclusions being reached. However, shortcut errors can occur as it lacks certainty and requires extensive experience (Croskerry, 2009; Geisler & Lazenby, 2009). Arguably, case pattern recognition is more difficult for novice students to develop as it requires clinical exposures and experiences to recognise these key features of clinical problems and subsequently, plan suitable treatment and management strategies (Croskerry, 2009).

Hypothetico-deductive reasoning is characterised by proposing a hypothesis and attempting to prove or disprove the hypothesis through clinical testing. Hypothetico-deductive reasoning is viewed as being more analytical and conscious, resulting in thinking which is more deliberate and slower in comparison to the quick intuitive thinking of case pattern recognition (Norman, 2005; Richards et al., 2020). Hypothetico-deductive reasoning facilitates reflection,

control and cognitive effort by allowing a longer time to reach a diagnosis, through slower cognitive processes (Koufidis et al., 2020). Experienced clinicians typically generate fewer and more accurate hypotheses of the medical problem than novices do, whereas novices struggle to a greater extent to think through a clinical problem and conduct an effective evaluative plan and clinical diagnosis (Geisler & Lazenby, 2009). Some of the characteristics of hypothetico-deductive reasoning include: procedural or analytical reasoning, critical, logical, deliberate and purposeful thinking. This is often a primary method for novices while experts use it in novel and complex medical problems (Croskerry, 2009). Hypothetico-deductive reasoning is viewed as being a thorough, linear and organised cognitive process, however, it can be slow, generating too many diagnoses to be considered, too much data collected and can cause perplexion by unexpected outcomes or results (Geisler & Lazenby, 2009). An example of this is where novice students ask a lot of subjective history questions of their patient, then proceed to perform every clinical test in an objective examination in an attempt to test multiple hypotheses they have generated to clinically diagnose this medical problem. This can result in students becoming frustrated and overwhelmed by the process and developing a fear of getting the wrong diagnosis (Colbert et al., 2024). However, students need to be taught to act like detectives and improve their cognitive filtering system, for e.g. allowing them to generate a maximum of 3 differential diagnoses in an attempt to more accurately diagnose the medical problem (Geisler & Lazenby, 2009). By teaching students how to use their cognitive processes more effectively, educators can provide more appropriate feedback to allow for effective remediation to occur in future clinical encounters (Geisler & Lazenby, 2009).

Eva (2005) proposed that a cognitive continuum exists where case pattern recognition and hypothetico-deductive reasoning are at differing ends of this continuum. This continuum is interactive, dynamic, and bi-directional, allowing individuals to move along this scale,

depending on their cognitive expertise, efficiency and accuracy of clinical reasoning (Bordage & Lemieux, 1991; Croskerry, 2009). Practicing clinicians typically use both types of thinking processes and move between the two, depending on the clinical scenario (Richards et al., 2020). This continuum should be promoted by educators to students with the understanding that both forms of clinical reasoning are necessary and complementary to each other (Eva, 2005). Fundamental to this cognitive continuum, is the ability of clinicians to reflect, monitor and evaluate their knowledge frequently. This is an important aspect of good metacognitive skill development (Elstein, 2009).

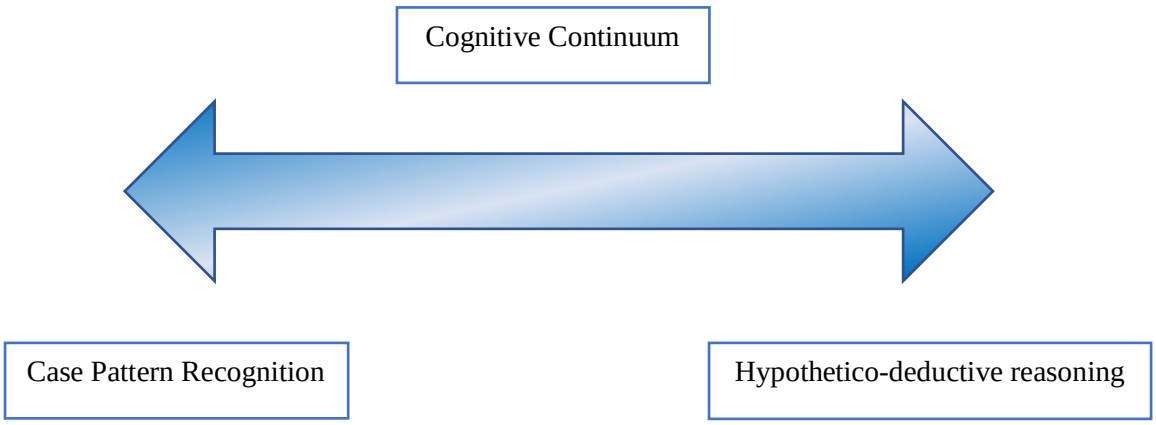

Figure 2.2: Cognitive Continuum Scale

2.2.3 The importance of clinical reasoning

Students and clinicians in any healthcare profession need to know vast amounts of clinical knowledge to be able to apply their clinical reasoning skills to the clinical encounters they are exposed to. Deficits and discrepancies in clinical reasoning compromises patient safety, morbidity and mortality. Deficits can result in medical errors occurring (Croskerry, 2009; Kononowicz et al., 2020; Lambe et al., 2016), a leading cause of death in many countries (Cleary et al., 2019; Medina et al., 2017). In medicine, two-thirds of diagnostic errors occur

due to clinical reasoning faults (Guraya, 2016; Norman & Eva, 2010), leading to misdiagnosis and litigation claims (Richards et al., 2020). Cognitive biases in medicine result in subconscious inaccuracies in interpreting clinical data, such as subjective and objective findings, leading to inaccurate medical diagnoses. These biases occur due to incorrectly applying clinical reasoning skills, involving case pattern recognition and hypothetico-deductive reasoning cognitive processes that govern human cognition (Richards et al., 2020; Thompson et al., 2023).

Medical errors are contributed to by a number of factors including cognitive biases, overconfidence and miscalibration. Over 100 cognitive biases have been described in the literature (Norman et al., 2017). Medical errors arising from knowledge deficits are a major contributor to diagnostic errors, due to failures in synthesising all available information correctly and failures in appropriate use of physical examination findings or diagnostic tests (Cooper et al., 2021; Norman et al., 2017). In addition, heuristics (mental shortcuts) also contribute to cognitive biases and errors, especially associated with case pattern recognition (Richards et al., 2020), whereby mental shortcuts and assumptions may be inadequate for sound clinical reasoning. This is evident when an atypical case presentation occurs, exposing cognitive bias. Similarly, common areas of clinical reasoning that allied healthcare students often struggle with are where cognitive biases arise from. This can be as a result of inadequate knowledge, clinical data gathering and processing, and metacognition (Gruppen, 2017; Norman & Eva, 2010).

Overconfidence bias and miscalibration occurs as a result of overestimation of a dominant contributing factor to a diagnosis (Cleary et al., 2019; Koufidis et al., 2020). Developing clinical reasoning expertise requires all clinicians and students to develop better abilities to recognise and detect these medical errors. Thus, a better understanding of when and

why medical errors occur and how to manage them during complex clinical encounters in the future is necessary (Patel et al., 2015). However, in order for this to be successful, “knowledge matters” (Norman et al., 2017 p.28). Prior knowledge and experiences are necessary for robust clinical reasoning. Identifying any clinical knowledge deficits is needed in the development of safe and effective clinical practice (Elstein, 2009). Notwithstanding this, diagnostic and cognitive errors will never be fully eradicated from clinical practice, as human cognitive clinical reasoning is far from perfect, and as a result mistakes will be made (Sklar, 2017). True learning comes after the mistakes are detected. Hence, metacognition is imperative to minimise mistakes from occurring by using metacognitive skills such as reflection and re-evaluation to cause meaningful future learning to occur. Thus, metacognition can be a useful de-biasing strategy to mitigate against cognitive bias (Richards et al., 2020; Trowbridge & Olson, 2018).

Typically, the majority of medical and healthcare students’ academic difficulties are as a result of deficits in clinical reasoning not medical knowledge (Duca & Glod, 2019), hence developing metacognitive abilities is of paramount importance. Konopasky et al. (2020) stated that there is no one entity that contributes or can be identified as a predictor of clinical reasoning errors or performance. In a clinical context, the ability to use knowledge improves thinking. The ability to step back and reflect on what is going on during a clinical encounter, can prevent a critical error from occurring and is the central principle of clinical reasoning (Croskerry, 2009; Magno, 2010). Therefore, developing metacognitive awareness has the potential to reduce cognitive errors through deeper understanding of self-regulative abilities such as self-reflection and self-evaluation skills needed to be a competent clinician (Guraya, 2016).

2.3 Metacognition in Allied Healthcare

2.3.1 History and definition of metacognition

Metacognition, as mentioned earlier, in its simplest term, is “thinking about thinking”. Metacognition was defined as “knowledge and cognition about cognitive phenomena” by Flavell (1979 p.906), stating it played an imperative role in all aspects of learning, through communication, reading, writing, memory, and problem solving. Metacognition was further defined into four key facets: 1) metacognitive knowledge 2) metacognitive experiences, 3) goals, and 4) actions (Flavell, 1979), as shown in Figure 2.3. Metacognitive knowledge was described as stored world knowledge and its interactions that lead individuals to evaluate and refine cognitive tasks and actions (Flavell, 1979). Metacognitive experiences were defined as any conscious cognitive or affective experience that is connected with an intellectual activity. Flavell (1979) described metacognitive knowledge and experiences as overlapping entities, as metacognitive experiences can cause an individual to establish new goals or affect metacognitive knowledge by creating new knowledge or refining it (Ben-David & Orion, 2013). Flavell outlined metacognitive goals as cognitive objectives, and metacognitive actions or strategies as how to achieve these goals. Since then, researchers have grouped goals and actions and relabelled them as metacognitive skills (Schneider, 2009). Over the past five decades most researchers agree that there is a difference between cognition and metacognition, where cognitive skills are needed to perform a task, whereas metacognitive skills are needed to understand how the task was performed (Schraw, 1998).

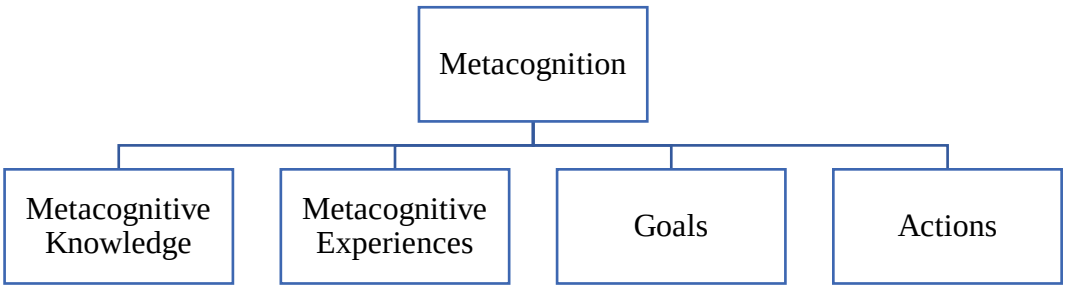

Figure 2.3: Model of Metacognition (Flavell, 1979)

Following on from Flavell's initial work, Schraw & Dennison (1994) published their seminal paper on assessing metacognitive awareness, defining metacognition as "the ability to reflect upon, understand and control one's learning" (p.460). They further delineated metacognition to be composed of two components known as knowledge of cognition and regulation of cognition, as shown in Figure 2.4. Knowledge of cognition refers to what individuals know about their thinking, how we learn, our ability to learn and the effectiveness and efficacy of our learning (Schraw, 1998). It is the reflective aspect of learning. Regulation of cognition is the ability to control and manage learning and decision making, through monitoring and evaluation. It is viewed as the regulatory control of learning and involves the actions we take (Ku & Ho, 2010; Schraw & Dennison, 1994). Knowledge of cognition is highly interconnected with regulation of cognition, and can enhance or limit learning depending on the ability and quality of the learner's knowledge and regulatory control processes (Ku & Ho, 2010; Rivers et al., 2020; Schraw, 1998). These concepts span across many subject domains, enhancing the generalisability and applicability, ultimately improving expertise in a domain area (Fleur et al., 2021; Schraw, 1998), and in this case, clinical reasoning in athletic therapy

and other healthcare professions. Therefore, the reflective aspect of learning and the regulatory cognitive processes to learn are central to clinical reasoning and thus to the development of the cognitive attributes of clinical expertise (Medina et al., 2017).

Knowledge of cognition can be viewed as what individuals know about their own knowledge, strengths and limitations. It is a very self-reflective process, and incorporates how to use this knowledge (Kosior et al., 2019; Schraw, 1994, 1998). Knowledge of cognition is further broken down into three subcomponents: declarative knowledge, procedural knowledge and conditional knowledge (Schraw, 1998; Schraw & Dennison, 1994), as shown in Table 2.1. Declarative knowledge refers to knowing information and facts and what factors influence one's performance, the "what" of knowledge (Schraw, 1998; Schraw & Moshman, 1995). Procedural knowledge refers to the "how" of knowledge and performing it as a skill or a behaviour and is represented in heuristics and strategies, whereby those with a high degree of procedural knowledge often do tasks more automatically as they can sequence strategies effectively (Schraw, 1998; Schraw & Moshman, 1995). Conditional knowledge refers to knowing "when and why" to use both declarative and procedural knowledge, such as when and why to use a particular skill, which then enables individuals to make adjustments if needed (Kosior et al., 2019; Schraw, 1998; Schraw & Dennison, 1994). Declarative, procedural and conditional knowledge components of metacognition, are underpinned by reflection, an integral role of metacognition.

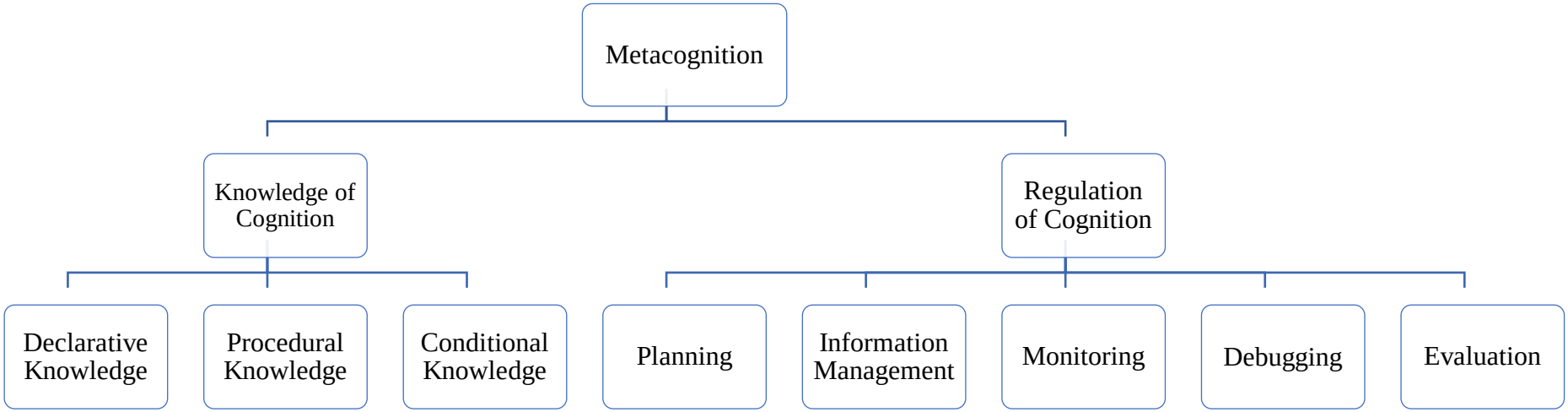

Figure 2.4 Model of Metacognition – eights components (Schraw & Dennison, 1994)

Regulation of cognition refers to activities that help individuals become aware of and control their thinking and learning (Kosior et al., 2019; Schraw, 1998). As a consequence, performance is improved through better use of additional resources and existing strategies (Schraw, 1998). Regulation of cognition is further broken down into five components: planning, information management, monitoring, debugging strategies and evaluation (Schraw & Dennison, 1994), as shown in Table 2.1. Planning involves choosing the best strategy and allocation of cognitive resources that will affect performance and achieve the desired outcome, prior to learning (Schraw, 1998; Schraw & Moshman, 1995). An example of this may be deliberate study methods, ordering of thoughts and goal setting (Kosior et al., 2019; Schraw & Dennison, 1994; Versteeg et al., 2021). Information management strategies refer to organising, summarising and actively reflecting on whether enough information was gathered to decide if a crucial element is missing, thus, reducing the chances of diagnostic errors from occurring (Schraw & Dennison, 1994). Monitoring encompasses an awareness of cognitive performance, through the ability to self-test and establish if progress is being made in a clinical scenario (Kosior et al., 2019; Schraw, 1998; Schraw & Dennison, 1994). This is evident in the learner's ability to utilise the clinical information and to check and evaluate if clinical progress is occurring during a treatment technique. Metacognitive monitoring plays a critical role in directing how individuals study and allows for the early recognition of cognitive biases or errors (Drigas & Mitsea, 2020; Schneider, 2009). Debugging strategies refers to intentionally looking for discrepancies and errors (Schraw & Dennison, 1994). This requires the learner to formulate differential diagnoses as part of the diagnostic reasoning challenge. Evaluation of learning refers to the ability to appraise, make judgements and globally assess if progress has been made in solving a clinical problem (Kosior et al., 2019; Schraw, 1998; Schraw & Dennison, 1994).

Table 2.1: Components of Metacognition

The Components of Metacognition			
Primary component	Sub component	Meaning	Practical example
Knowledge of Cognition	Declarative knowledge	Knowing information and facts; the "what" of knowledge	Student acquires and learns knowledge pertaining to epidemiology, aetiology, pathophysiology, clinical presentation, differential diagnosis, treatment and management of Anterior Cruciate Ligament (ACL) injuries.
	Procedural knowledge	The "how" of knowledge and performing it as a skill or a behaviour	Student uses their procedural knowledge in how to perform a Lachman's test and anterior drawer test for ACL integrity, pain and laxity or how to develop a rehabilitation program.
	Conditional knowledge	Knowing "when and why" to use a particular skill	Student knowing when and why to perform these tests, based on relevant subjective and objective questioning and the context of the situation.
Regulation of Cognition	Planning	Choosing the best strategy and allocation of cognitive resources that will affect performance and achieve the desired outcome	Student evaluates all the pertinent findings from the subjective and objective clinical assessment and outlines suitable ACL treatment and rehabilitation goals with the patient.

	Information management strategies	Actively reflecting on whether enough information was gathered	Student actively reflects on the information gathered from the clinical assessment as to whether it was sufficient in accurately diagnosing and treating the patient's injury as an ACL rupture. If insufficient information is obtained, the learner/ clinician may develop a strategy to obtain the extra information.
	Monitoring	Awareness of cognitive performance, through the ability to self-test and establish if progress is being made	Rehabilitation exercises are given to the patient and outcome measures are monitored such as measuring quadriceps strength using a dynamometer.
	Debugging strategy	Intentionally looking for discrepancies and errors	The ability of the student to ask is there another diagnosis I'm missing? What other assessments could I perform to accurately diagnose and treat the patient?
	Evaluation	The ability to appraise and globally assess if progress has been made	The ability to re-assess a patient's treatment goals and outcomes measures weekly, ACL return to play protocol is being made in a timely manner.

Knowledge of cognition and regulation of cognition span many professional areas and are both domain-general and domain-specific entities (Schraw, 1998). Metacognition is a teachable skill which is not hardwired in the brain, allowing individuals to control, learn and improve their cognitive skills, applicable in all domains (Rivers et al., 2020). Therefore, the implication to learning is significant and teaching thinking skills to students across all educational levels is imperative for the development of competent future clinicians (Georghiades, 2004).

2.3.2 The development of metacognition across the lifespan

Metacognitive development starts early in childhood, from the age of 4-6 years old (Kuhn, 2022). At this time, children begin to develop metacognitive awareness and understanding and exercise some degree of control over their cognitive processes (Kuhn, 2000; Schraw & Moshman, 1995). From young childhood to young adulthood, metacognitive knowledge increases substantially with age and is not complete by the end of childhood (Schneider, 2009). Metacognitive regulatory control develops around 8 years old and both knowledge and regulation of cognition continue to develop into adulthood (Fleur et al., 2021). Metacognition continues to develop throughout the lifespan of an individual, however, little is known regarding this process and further examination is needed (Azevedo, 2020). In particular, we do not have a full understanding of the metacognitive development that undergraduate students typically experience (Stanton et al., 2015).

Developing metacognition and becoming competent and motivated in knowing what you know puts individuals in charge and control of their knowledge, arguably one of the most important traits an individual can possess (Kuhn, 1999). Children who develop good metacognitive awareness are more likely to become successful learners now and into the future,

compared to children who have poorer metacognitive skills (Perry et al., 2019). Furthermore, they know how to think and can justify "why". However, some caution should be given to overconfidence and false certainty (Von Hoyer et al., 2022). Despite this, metacognitive skills should be developed at a young age and continue into adulthood in collaboration with educators, embedding metacognition throughout all levels of education by making it explicit in curricula (Braund, 2022).

2.3.3 Importance of metacognition

Metacognition allows us to examine and reflect upon how we learn and promotes active self-regulatory control of our learning (Avargil et al., 2018; Rivas et al., 2022), enabling deep, meaningful, and impactful application of knowledge and skills (Welch et al., 2018). Metacognition supports problem-solving and the ability to monitor and apply appropriate skills and strategies, to achieve a desired outcome (Medina et al., 2017). This ability to reflect, evaluate, identify learning deficits and make cognitive adjustments enables students to become more cognitively aware (O'Loughlin & Griffith, 2020; Stanton et al., 2021). Due to the dynamic nature of learning, where knowledge acquisition and understanding is central to effective thinking and learning (Rivas et al., 2022), some individuals are unaware of their own metacognitive skills (Avargil et al., 2018).

Metacognition plays a critical role in comprehension (Wilson & Bai, 2010) and facilitates individuals to better manage and control their cognitive skills (Kuhn, 2000; Schraw, 1998). It also improves classroom communication thus impacting students' performance (Hartman, 2001). Metacognition guides learning strategies and allows a focus on acquiring knowledge that is missing or lacking, in order for further future learning to occur (Medina et al., 2017). This facilitates more meaningful and deeper learning in comparison to rote learning,

memorization and surface learning, such as reading and highlighting notes which are commonly used by students (Joshi et al., 2022; Medina et al., 2017; O'Loughlin & Griffith, 2020; Rivers et al., 2020). Therefore, unless students are educated on the importance of metacognition, their perceptions and study techniques may be far from optimal. Versteeg et al. (2021) demonstrated that some medical students did not see the need to develop metacognitive skills as they perceived medical education to be based on memorisation of knowledge. As was observed in England's National Curriculum (Perry et al. 2019), metacognition was not formally mentioned in their national government educational framework and guidance to educators. Similarly, it was not stated in the National Council for Curriculum and Assessment in Ireland (NCCA 2025). Hence, the importance of metacognition needs to be recognised and specifically highlighted throughout all levels of education to aid students' learning.

2.3.3.1 Academic performance

Metacognitively aware students perform better and are more strategic (Schraw, 1998), as they have a better ability to plan, monitor and control their learning in a way that directly improves performance, including academic success ($p<0.05$) (Schraw & Dennison, 1994). The assessment of metacognition is usually used as a predictor of grades or academic performance (Fleur et al., 2021), independent of intellectual ability (Van Der Stel & Veenman, 2010). In a recent meta-analysis review of 127 studies, metacognition was positively correlated to academic performance ($r=0.28$, $p <0.001$) and intelligence ($r=0.33$, $p <0.001$) (Ohtani & Hisasaka, 2018). Having strong metacognitive awareness leads to improved self-awareness, ownership and responsibility of self-directed learning and lifelong learning. This in turn leads to enhanced academic performance, with a positive growth mindset (Cale et al., 2023).

Planning and monitoring as metacognitive skills are strong predictors of academic performance ($p<0.001$) (Van Der Stel & Veenman, 2010). However, during qualitative interviews, Versteeg et al. (2021) found that medical students devoted little time to these skills. In contrast, students who were organised, applied a deep metacognitive approach to learning, and so displayed stronger metacognitive awareness than unorganised or dissonant students ($r=0.527$, ($p=0.001$) (Tuononen et al., 2022). In addition, metacognitive monitoring was found to significantly improve students' academic performance ($p=0.002$) (Wagener, 2016). Students indicated their global understanding of the day's lesson and then wrote down any concepts they found difficult to comprehend and their plans to address knowledge gaps to enhance their learning. At the end of each week, students completed 3 multiple-choice questions and rated their confidence in the answers they provided (Wagener, 2016). This highlighted that the integration of metacognition can occur in a very simple and user-friendly way for both students and educators, having profound effects on students' academic performance (Abdelrahman, 2020).

2.3.3.2 Lifelong Learning

Lifelong learning requires self-directed and self-regulated learning, putting the responsibility of learning on the clinician through continuous professional development, a prerequisite for successful professional body memberships (Medina et al., 2017). Lifelong learning is necessary due to the ever changing medical and healthcare landscape. Having strong lifelong learning skills can help allied healthcare professionals to maintain a high standard of care, helping clinicians to adapt to unpredictable and complex clinical cases (Cale et al., 2023). Having good metacognitive awareness, in particular good monitoring and evaluation skills, is critical for individuals throughout their lifetime when engaging in learning (Avargil et al., 2018). As metacognition is a lifelong learning skill, it can be continuously improved,

particularly with consistent and deliberate practice. Equipping students with these metacognitive skills is necessary not just to enhance their discipline or domain-specific skills, but also their overall general knowledge and learning for life (Dennis & Somerville, 2022).

2.3.3.3 Expertise

Expertise and metacognition are tightly coupled and interlinked (MacIntyre et al., 2014), whereby as clinicians develop expertise, metacognitive knowledge and regulation continues to improve. Similarly, as students acquire increased metacognitive knowledge, they construct more general understanding that transcends multiple domains, hence their metacognitive knowledge becomes more flexible and they can apply new knowledge to new areas of learning (Schraw, 1998). This is evident as metacognitive knowledge improves and expertise develops, going from domain-specific to more domain-general, thus exploiting translatability of learning skills to different contexts (Fleur et al., 2021). Sophisticated metacognition is closely related to general and domain knowledge, motivation, adoption and application of learning strategies (Drigas & Mitsea, 2020; Schneider, 2009). Experienced educators are better able to monitor, interpret and evaluate what happens in the classroom than novice and inexperienced educators (Hartman, 2001). Cale & McNulty (2024) demonstrated that for educators who participated in a metacognitive training course, both metacognitive reflection ($p = 0.018$) and metacognitive knowledge ($p = 0.027$) significantly improved, thus providing greater insight and expertise into their teaching practice. Similarly, expertise develops as clinicians gain more exposure to patients, encapsulating their knowledge further (Schmidt & Mamede, 2020). Equally, this increase in exposure is also true for the development of metacognitive knowledge and skills. Metacognition allows students to develop their thinking to be more expert-like (Stanton et al., 2021). Metacognition gradually evolves as a multidimensional competence over time through explicit instruction (Zohar & Barzilai, 2013).

Therefore, becoming more aware of our thinking and abilities to reflect, monitor and control our thinking processes helps frame metacognition as a construct not only necessary for academic achievement (Kuhn, 2000), but also very important during clinical encounters, particularly, for students during the immersive clinical placement in athletic therapy and healthcare education.

2.3.4 Importance of metacognition in clinical reasoning

Clinical reasoning in medical and allied healthcare professions requires clinicians and students to apply domain-specific medical knowledge and skills to determine the clinical problem. It also uses metacognitive processes to plan, monitor and evaluate these thinking processes (Wang et al., 2023). Metacognition helps clinicians better prepare for future patient encounters and learning, through the careful reflection and evaluation of all forms of evidence from past experiences and learning, both internally and externally (McKeon & McKeon, 2020). This is as a result of the interconnected cognitive processing of clinical reasoning that requires executive control and meta-level operation of thinking that comes from metacognition (Magno, 2010). The interconnectedness of both knowledge of cognition and regulation of cognition is evident when we use metacognitive control of learning to enhance the integration of clinical and basic science in the form of declarative knowledge, enabling more effective diagnostic reasoning. This reasoning can be subject to metacognitive monitoring, as diagnostic reasoning can reveal gaps in the student's knowledge where future learning, planning and goal setting can remediate these gaps, enabling the student to exercise more regulatory control of their learning. Rivas et al. (2022) found that metacognition improved significantly in first year psychology students simultaneously as critical thinking skills also improved ($p= 0.001$). Therefore, clinical reasoning may be the connection between metacognition and the development and application of clinical knowledge within the patient's contextual environment

(McDevitt et al., 2019). However, conceptualizing and teaching clinical reasoning remains challenging, resulting in students having difficulty with the process, despite its central role in healthcare education. If educators want to develop clinical reasoning skills in students, they first must teach them how to learn through developing their metacognitive abilities (Wilson & Bai, 2010). Challenges exist for educators in teaching clinical reasoning skills to students whereby they must make the invisible cognitive skills visible, but also find effective ways to convey their expert knowledge and reasoning skills to novice students, nurturing their own development of expertise (Eva, 2005). This conscious awareness of thinking, exemplifies the significant role metacognition plays in clinical reasoning, making complex cognitive processes overt and conscious through the explicit integration of metacognition into clinical practice and education (Kosior et al., 2019).

The ability to be a self-regulated learner is a very important skill for healthcare professionals to possess, and is seen as a prerequisite for effective learning (Richards et al., 2020; Versteeg, et al., 2021). However, many students struggle with the level of metacognition needed. In order to be a self-regulated learner, reflection is necessary on all parts of the task, allowing for modification to occur to improve performance (Versteeg et al., 2021). Reflection is viewed as the most substantive form of cognitive knowledge activity to inform and transform professional practice. Consequently, reflection increases practitioner accountability and professional effectiveness (Anderson et al., 2004), where metacognition becomes a tool for reflection. “When we reflect upon an experience instead of just having it, we inevitably distinguish between our own attitude and the objects toward which we sustain the attitude. Such reflection upon experience distinguishes what we experience (the experienced) and the experiencing the how” (Dewey, 1916 p.173). In athletic therapy clinical practice and education, reflecting upon past experiences (both good and bad), both internally and externally (with peers

and mentors) is an iterative process that helps clinicians make sense of professional success and failures. Therefore, reflection is a central component of metacognition and clinical reasoning. Reflection-in-action is an ongoing metacognitive activity that is occurring during every patient encounter while reflection-on-action occurs post physical examination (Huhn et al., 2019). Clinical reasoning is best developed by strategies that give intentional deliberate practice in clinical experiential learning environments supported by reflection and feedback (Khin-Htun & Kushairi, 2019). In addition, as the clinician reviews and refines their clinical reasoning and management plan of the patient, reflection-on-action links old knowledge and new knowledge together, seeking to address knowledge gaps. Reflective practice may lead to the formation of new knowledge, thus changing clinical or learning practices for clinicians and students alike (Kump et al., 2015).

To be safe and effective clinicians, allied healthcare professionals must continually learn and expand their knowledge and skillsets to possess strong clinical reasoning and metacognitive skills. However, when examining students' metacognitive judgements and clinical reasoning in patient encounters, students found the subjective history assessment more challenging than the physical examination (Cleary et al., 2019). In addition, in this study, 98% of students overestimated their performance. This reinforces the central role and importance of both clinical reasoning and metacognition for allied healthcare professionals and students in their educational training.

2.3.5 Measuring metacognition

The measurement of metacognition is very important for both students and educators to accurately determine students' academic performance and progression. It can also be used as an educational tool to help students' engage in reflection and metacognitive strategies

(Kosior et al., 2019; Rivers et al., 2020). Due to the highly subjective and individualised nature of metacognition, it is not directly observable, resulting in challenges in measuring it (Stanton et al., 2021). Therefore, measurement tools are limited and present a major challenge for educators to objectively measure metacognition (Craig et al., 2020; Perry et al., 2019). Common measurements of metacognition are broken down into on- and off-line measurements (Ohtani & Hisasaka, 2018; Veenman, 2013). Off-line measurements typically assess students' self-reporting prior to or after a task, such as self-reported questionnaires or interviews (Craig et al., 2020; Ohtani & Hisasaka, 2018; Veenman, 2013). Online measurements are typically assessed during a task or performance, such as think-aloud protocols or metacognitive judgements (Fleur et al., 2021; Song et al., 2021). The measurement of metacognition can occur at different time points, thus for more reliable measurements concurrent or retrospective methods are preferred (Craig et al., 2020). In addition, metacognition is rarely studied on its own, it is often assessed in conjunction with a learning skill, problem-solving or a teaching intervention (Zohar & Barzilai, 2013). Limited literature and guidance exist for educators on how best to measure students' metacognition, for example, before and after a module is delivered or what measurement tools to use. Directly measuring metacognition using a self-reported questionnaire or indirectly measuring it using other performance measurements, such as the diagnostic reasoning inventory as a measure of clinical reasoning performance, has yet to be recommended by the literature. Therefore, further research in this area is needed to establish best practices in the measurement of metacognition.

The Metacognitive Awareness Inventory (MAI), developed and validated by Schraw & Dennison (1994), is a very common off-line measure of metacognition (Appendix A5). The 52-item self-reported inventory questionnaire assesses both knowledge of cognition (17 items) and regulation of cognition (35 items), inclusive of all 8 subcomponents of metacognition,

representing a comprehensive assessment (Harrison & Vallin, 2018; Schraw & Dennison, 1994). The original version of the MAI asked participants to rate each question as either true or false (Schraw & Dennison, 1994). More recently, researchers frequently use the 5-point Likert scale ranging from 1 – always false to 5 – always true, in which participants report their level of agreement with all the items/statements (Kosior et al., 2019; Schraw & Dennison, 1994). The stronger the agreement, the higher the results (Harrison & Vallin, 2018; Schraw & Dennison, 1994). The MAI has demonstrated excellent reliability as a measure of total metacognitive awareness ($\alpha = 0.95$), knowledge of cognition ($\alpha = 0.91$), and regulation of cognition ($\alpha = 0.91$) (Schraw & Dennison, 1994). Recent research has demonstrated acceptable ($\alpha = 0.7$) and good reliability ($\alpha = 0.84$) for the MAI in anatomy students (Cale et al. 2023) and medical students (Siqueira et al. 2020), respectively. No information pertaining to the MAI exists for athletic therapy students or educators.

Self-reported questionnaires such as the MAI are cost-effective, time efficient and easy to administer to large scale participants (Harrison & Vallin, 2018). However, considerations are needed when using the Likert scale in the MAI, as it may be influenced by response bias. One such response bias is acquiescence or agreement bias where respondents choose to agree regardless of content of the question (Primi et al., 2019). Using a 5-point Likert scale, the researcher is allowing participants to express a neutral opinion, neither agreeing or disagreeing with the statement. This may also be influenced by social desirability bias, where the participant may select an option such as neutral or midpoint statement to be more socially acceptable or desirable than leaving it blank (Chyung et al., 2017; Rovers et al., 2019). The issues that surround this method are participants may use the midpoint as a safe option when they do not know enough on the survey topic or they think it is a socially desirable answer. However, the main benefit of using a Likert scale is you are not compelling participants to

simply agree or disagree with the statement, gauging level of agreement. A further consideration of using MAI is that if an individual possesses good metacognitive knowledge, it cannot be assumed that the individual always uses and activates the metacognitive strategies to support learning (Ohtani & Hisasaka, 2018). The use of the MAI in conjunction with clinical reasoning tests has yet to be examined and an area for further research (Kosior et al., 2019).

Literature also supports the use of mixed-methods or qualitative research to gain a richer and in-depth view of participants' (educators, students or clinicians) metacognitive awareness as a measurement method (Craig et al., 2020). Ohtani & Hisasaka (2018) stated interviews and think aloud methods assess metacognition more precisely than offline methods, such as self-reported questionnaires. Interviewing a participant about the strategies they employed on a task that they just completed or general strategies that they use, can provide rich detailed information to measure metacognitive awareness. Ohtani & Hisasaka (2018) conducted a meta-analysis of academic performance and different measurements of metacognition and found that think-aloud methods ($r = 0.54$, $p < 0.001$) and interviews ($r = 0.45$, $p < 0.001$) were significantly and positively correlated. However, major limitations to these online measurements, such as think-aloud and interviewing are the associated costs and difficulties conducting these in large populations (Ohtani & Hisasaka, 2018). In general, the literature relating to measuring metacognition is limited and requires future research to establish best practices for researchers, educators and students to use.

2.3.6 Metacognitive awareness of students

Learning should be a proactive activity that students should do to increase their knowledge and skills in a particular area (Zimmerman, 2002). Learning in higher education requires students to take responsibility for their time, resources and how they learn (Dennis &

Somerville, 2022), which can be difficult to effectively and efficiently do. A metacognitively aware student understands the process of learning, knows what to learn, how to learn it and understands the "whys" of their learning (Lumpkin, 2015). Hence, the development of metacognitive awareness is of critical importance to develop students' independent work and learning, as competent self-directed and self-regulated learners (Wilson & Bai, 2010). Having good metacognitive awareness is not a single personal trait that an individual can possess, as evident from the theoretical framework of metacognition, instead it encompasses 8 different subcomponents. All components are equally relevant and needed by students and clinicians in the development of good metacognitive awareness. Equally, without a robust understanding and good metacognitive awareness, students will struggle to transfer and apply knowledge from one context to another (Biwer et al., 2023). As a result, information learned is soon forgotten and students then need to spend additional time re-learning the same content again.

For students to be more metacognitively aware, they need to consciously engage with learning inside and outside of the classroom (Gamby & Bauer, 2022). Ku & Ho (2010) examined undergraduate students' critical thinking skills using a think-aloud protocol, whereby those that engaged more and spent more time (6.73 minutes longer) on metacognitive strategies were better critical thinkers, had a better ability to plan and guide thinking and evaluate their approaches, leading to enhanced performance ($p<0.05$). Interestingly, motivation to learn and metacognitive awareness were examined and found to be closely related, with a significant association between knowledge of cognition and mastery goal-orientated students ($p = 0.003$), who prioritised the development of competencies and skills and deep learning techniques (Siqueira et al., 2020).

Students who were regarded as having better metacognitive monitoring ability ($r = 0.42$, $p < 0.01$) performed better and were more confident and accurate than college students who

displayed poorer monitoring ability (r = -0.11) (Schraw, 1994). Individuals with poor metacognitive awareness tend to overestimate their performance, commonly referred to in the literature as the Dunning-Kruger effect, suggesting that they have poor insight or are less aware of their cognitive process than individuals with good metacognitive awareness (Song et al., 2021). Cale et al., (2023) examined physician assistants, physical therapy and occupational therapy students' metacognitive awareness and found that both high and low academically performing students accurately evaluated their learning and were able to predict their performance during examinations. However, middle performers displayed the largest disconnect in their performance or evidence of the Dunning-Kruger effect, which may be a result of poor metacognitive abilities to see their shortcomings or failings, and misperceptions and overestimations of their actual performance. In contrast, high performers have a large knowledge base and more accurately self-evaluate their performance whereas, low performers have the smallest knowledge base but acknowledge the gaps in their knowledge (Cale et al., 2023). Similarly, McCabe (2011) found that undergraduates were largely unaware of effective learning strategies that could improve their academic performance and displayed an inability to accurately predict their learning. In addition, individuals with poorer metacognitive awareness typically have a tendency to rely on intuition rather than analytic judgement. Ultimately, this could result in cognitive and clinical reasoning errors occurring in comparison to individuals with stronger metacognitive awareness, facilitating more metacognitive control and monitoring of strengths and weaknesses (Song et al., 2021).

Metacognitive knowledge and skills are deeply linked to self-efficacy and students' belief and confidence in their ability to succeed during different tasks or performances (Gamby & Bauer, 2022). Students' ability to metacognitively monitor or calibrate their knowledge and confidence were examined by Von Hoyer et al., (2022). They found second year medical

students and first year physiotherapy students' confidence levels increased in both correct ($p < .001$) and incorrect knowledge ($p < .001$) questions after a learning experience. This could mean that students are better able to judge what they do know but worse in knowing what they do not know, leading to an overestimation of one's ability (Dunning et al., 2003; Kruger & Dunning, 1999). This could have a significant detrimental effect on patient care if future clinicians have high confidence in the wrong knowledge. This may stem from healthcare professionals being reluctant to admit their uncertainty in clinical reasoning skills (Von Hoyer et al., 2022). If students are inaccurately judging their learning and demonstrating poor metacognitive awareness, this can result in students becoming overconfident in the topic and leading them to underperform (Rivers et al., 2020). Furthermore, students may be putting unrealistic expectations on themselves to always have the correct diagnosis or treatment plan, while not using their metacognitive skills to cognitively work out the complexity and uncertainty of clinical problems. Students with lower metacognitive awareness may not be aware of the significance of self-monitoring and as a result find it difficult to monitor their cognitive process in some situations (Jang et al., 2020). In contrast, 49% of undergraduate biology students monitored the effectiveness of learning strategies' and correctly identified those that were helpful and unhelpful, providing explanations for their choices (Stanton et al., 2015). As a result, 13% reported increased engagement with learning material. Hence, teaching students to become metacognitively aware requires them to put this into action, by providing students with opportunities to engage and practice their metacognition (Wilson & Bai, 2010).

Metacognitive awareness ($p < 0.001$), critical thinking ($p < 0.001$), problem-solving ($p < 0.001$), and communication skills ($p = 0.04$) were significantly enhanced in first-year nursing students after active learning strategies, such as flipped classroom, were embedded into their course for a semester (Chan et al., 2021). In addition, 78% of students found the teaching

strategies to be good/great or excellent, while 55% of students found them to be quite sufficient and rewarding. Furthermore, both knowledge of cognition ($p < 0.001$) and regulation of cognition ($p < 0.001$) were significantly higher at the end of the semester (Chan et al., 2021). Similarly, graduate medical students' knowledge of cognition was positively and significantly related to their goal setting ($p < 0.001$) and subsequently problem-solving ($p < 0.05$), monitoring ($p < 0.05$), and evaluation of the clinical problem ($p < 0.001$) (Wang et al., 2023). Contrastingly, no significant increases in metacognitive awareness were observed between first year and final year medical students. However, weak correlations between first year medical students and their end of year examination results were noted for knowledge of cognition ($r=0.32$, $p<0.04$) whereas final year medical students end of year examination results were moderately highly correlated for knowledge of cognition ($r= 0.69$, $p < 0.04$) (Welch et al., 2018).

Deconstructing the metacognitive components involved in clinical reasoning may enable learners to better understand the content and its application to clinical reasoning (Kosior et al., 2019). This may occur by explicitly structuring and guiding learners' thinking and reasoning. Educators should integrate metacognition into an everyday part of the classroom by using this terminology and language. Fostering the student's ability to discuss their cognition and learning through the use of novel assessment strategies that provide tools to scaffold learning, metacognitive habits, and lifelong learning is also necessary (Cutrer et al., 2021; Versteeg et al., 2021). However, it first requires educators to be metacognitively aware.

2.3.7 Metacognitive awareness of Educators

Limited knowledge and research exists on educators' explicit awareness of metacognition across all educational levels (Ben-David & Orion, 2013; Wilson & Bai, 2010).

This is evident in Georghiades (2004) review of 30 years of metacognitive research, stating that the average science educator does not know about metacognition. Establishing educators' metacognitive awareness is imperative to enable them to possess a sound pedagogical understanding of metacognition and therefore, be able to teach students to be metacognitive thinkers (Wilson & Bai, 2010; Zohar & Barzilai, 2013). In addition, students' metacognitive development and growth is influenced by educators' thinking, resources and support available to them (Ben-David & Orion, 2013; Jiang et al., 2016). Thus, an educator's self-awareness of metacognition is a prerequisite to enhance students' metacognition (Jiang et al., 2016). In other words, if educators intend to teach students to think metacognitively, they first must be metacognitively aware. Often educators teach the way they were taught, rather than considering alternatives or seeking out new innovative teaching practices (Hartman, 2001). Hence, changing educators' thinking and affecting educators' practice can be difficult and very different things (Zohar, 2006).

Educators who exercise good metacognitive awareness, plan, monitor and evaluate their teaching practices, which are required for effective teaching practice (Jiang et al., 2016; Ozturk, 2017; Zohar & Ben-Ari, 2022). In addition, they are metacognitively adaptive, whereby their thinking evolves and adapts depending on the context and environment (Jiang et al., 2016), based on reflective teaching. Similarly, Ellis et al. (2014) noted that educators who reflect and evaluate the effectiveness of their teaching practice can identify pedagogical areas of strengths and weaknesses, further supporting the need for educators to demonstrate good metacognitive awareness (Zohar & Ben-Ari, 2022). This reflection by educators can have a strong impact on their teaching practice and thus, affect student learning (Wass et al., 2023).

Prior to primary school educators undertaking in-service teacher training, 91% were completely unaware of metacognition, reflecting a major gap between theory and practice

(Ben-David & Orion, 2013). Similarly, Zohar (2006) found that high school educators' metacognitive knowledge was poor and unsatisfactory for teaching metacognitive thinking skills to students. When participants were asked what thinking skills they emphasised in their teaching, 80% of participants could not answer this question. This fragile metacognitive knowledge was further highlighted by Zohar & Lustov (2018), which resulted in educators trying to teach metacognition in a very mechanical or fixed way. Educators' knowledge of metacognition and their pedagogical knowledge was lacking, particularly in the instruction of metacognitive strategies (Zohar & Ben-Ari, 2022). Educators often aim to facilitate *"learning to learn"* environment in the classroom and teaching metacognition facilitates this for successful student learning to occur. However, very limited research exists about educators' metacognitive awareness and understanding for those working in higher education. Furthermore, no research to date has examined athletic therapy educators' metacognitive awareness in Ireland or globally. Therefore, research is required to examine the extent of educators' knowledge of metacognition, as it is imperative that allied healthcare and athletic therapy educators are familiar with metacognition and possess good metacognitive awareness, in order to develop these metacognitive thinking skills in our students.

2.3.8 The role of educators in developing metacognitive awareness in students

Educators play an important role in supporting and developing students' metacognitive abilities. Educators' largest impact on student learning is when they identify and help address students' knowledge gaps. This type of metacognitive teaching is incremental and experiential (Trowbridge & Olson, 2018). Understanding that metacognition is not a skill to be taught per se, but rather a way to think and learn is necessary for educators to grasp (Wilson & Bai, 2010). Moreover, educators' self-efficacy in teaching metacognition is an important and influential factor to be considered when supporting students' metacognitive development. Positive

correlations were found between educators self-efficacy and the intrinsic value of tasks ($p = 0.038$), in which educators who felt competent in promoting metacognition assigned more value to it ($p = 0.015$) (Karlen et al., 2023). Furthermore, educators' pedagogical understanding of what is required for effective teaching and learning has a significant impact on their practice and their students' learning (Karlen et al., 2023). Educators implementing metacognitive teaching strategies' should have knowledge of how to use metacognition in a variety of different contexts and how to scaffold and bridge students' thinking (Zohar, 2006). As a result, educators need robust and sophisticated pedagogical knowledge (Zohar & Barzilai, 2013), as having a good sound content knowledge does not necessarily mean having the ability to teach content (Barrett et al., 2018).

Metacognitive thinking is abstract, tacit and difficult to articulate (Lumpkin, 2015; Wilson & Bai, 2010). For many, it is a process that just happens (Golding, 2019). However, literature consistently states that there is a need for metacognitive thinking to be made explicit and the more explicit it is, the more likely it is that students will develop these metacognitive skills (Schraw, 1998). Educators also need to remind themselves and appreciate that each student is different, as is their experience of how they learn, hence a very individualised approach to learning is warranted. Wilson & Bai (2010) recommended that in order to develop students' metacognition, educators need to make time for students to discuss their problem-solving, share their thinking and ask questions. Educators can facilitate discussions, model their own thinking processes, and provide students with activities that allow them to explain their answers as methods to aid this development. Fostering students' metacognitive thinking and their clinical reasoning during the early years of their athletic therapy educational training is needed, as students' knowledge and skillsets will continue to be progressed and defined as they continue into their later years of their educational studies (Guraya, 2016). However, if this does

not occur until later on in their undergraduate degrees, missed opportunities in aiding students' learning and academic performance may occur, ultimately affecting their refinement of clinical reasoning skills.

Educators should not assume that all pre-planned and well-designed learning experiences will result in a positive educational experience for students, or alternatively not all experiences are educative (Geisler & Lazenby, 2009). In some cases, a gap can exist between the educator's perceived teaching and the student's actual learning (Geisler & Lazenby, 2009), hence teaching does not equal learning (Hartman, 2001). Educators cannot teach effectively what they do not know (Zohar, 2006). This is evident in the criticism and challenge facing educators, whereby novice students cannot be expected to be given large amounts of predetermined knowledge (e.g. clinical presentation data), skills (e.g. performing objective and clinical testing) and then directed to link them with practice and experience on their own accord (Geisler & Lazenby, 2009). This results in students relying on memory recall from such a large breadth of information to accurately diagnose a patient, without potentially having the adequate metacognitive learning scaffolds needed to efficiently organise their knowledge and actions for effective patient care. Unsurprisingly, if students aren't educated in the various metacognitive learning strategies, they will not be able to use them. Hence embedding them into curricula is of paramount importance (Pintrich, 2002). Therefore, students must be taught to be metacognitive thinkers and doers. However, this can only be achieved if educators possess good metacognitive awareness, and this remains unknown in an Irish context within athletic therapy education.

Developing metacognition requires students to integrate their knowledge more succinctly and deconstruct clinical problems, developing more efficient clinical reasoning skills to enhance patient care (Kosior et al., 2019). To assist this, educators must remove

themselves from the centre of the classroom and more to the side-lines of the classroom, to allow students more independence and opportunities to practice their skills and their thinking (Barrett et al., 2018). Educators should be viewed as mediators and guides (Kuhn, 1999; Rivas et al., 2022), when promoting a metacognitive teaching environment. However, cultivating a metacognitive environment in higher education does not occur automatically for some (Tanner, 2012). Understanding the barriers and facilitators to implementing metacognitive teaching strategies into the athletic therapy classroom is needed in an attempt to overcome any barriers.

2.3.9 Metacognitive teaching strategies

Despite educators' desire to have a universal approach to teaching and learning, no two students are the same, nor are their learning experiences (Eva, 2005). In order for a new innovative learning technique to be successful, students must be cognitively engaged. Hence, students' understanding of metacognition is critical for the successful implementation into curricula and classrooms (Schraw, 1998). When developing metacognitive strategies, educators need to be very intentional in structuring learning experiences to help develop and shape their students' clinical reasoning skills (McDevitt et al., 2019). As a result, planning is a core component of metacognition for both educators and students alike. Students learn better when they plan and prioritise the importance of thinking about their learning process over the actual content, prompting them to activate prior knowledge and identify what they do and do not know (Medina et al., 2017; Stanton et al., 2021). The development of clinical reasoning not only relies on acquiring knowledge, but, more importantly, the organization and structuring of this knowledge to make it accessible for clinicians and student clinicians to quickly retrieve during a clinical encounter (Linsen et al., 2018). There are many different ways in which athletic therapy educators can implement metacognitive strategies in the classroom, such as active learning strategies, deliberate practice and feedback, and reflective practice (Khin-Htun

& Kushairi, 2019). The identification and correction of knowledge and skills of a clinical problem results in remedial measures occurring, without compromising patient safety (Mamede & Schmidt, 2022; Patel et al., 2015). Promoting all aspects of metacognition forms the basis of clinical reasoning pedagogy and this can be achieved by using metacognitive teaching strategies (Kosior et al., 2019).

2.3.9.1 Role modelling

Role modelling is a powerful tool for educators to demonstrate their thinking processes (Richards et al., 2020) and for students to visibly "see" metacognition and clinical reasoning in-action (Newsom et al., 2022). Role modelling requires students to observe, reflect and translate insights into actions and behaviours. Developing conditional knowledge ("when and why") through role modelling exposes students to different clinical cases, encouraging them to look at different contexts and the "bigger picture" of a clinical encounter (Khin-Htun & Kushairi, 2019; Teunissen et al., 2021). Explicitly showing students how to "think like an athletic therapist" is a powerful way of visibly showing students the cognitive processes that clinicians, preceptors and educators undertake during a clinical encounter. Learners do not operate in a vacuum but rather in real-world complex clinical practice, where context specificity is important (Eva, 2005; Koufidis et al., 2022; Ward & Diug, 2022). This should be consciously considered and cultivated by educators and preceptors (Joshi et al., 2022).

Role modelling through the use of simulation allows educators to use this teaching method to immerse students into realistic clinical scenarios to deliberately practice their clinical reasoning, reflection, and domain-specific skills (Kosior et al., 2019). Simulation engages students in lifelike experiences that mimic real clinical encounters, providing a safe environment for students to learn and master clinical skills (Armstrong et al., 2024; Cuchna et

al., 2019a). Advancing this area of simulation education further, augmented reality and virtual reality are emerging technological tools that allow students to immerse themselves into artificial or virtual clinical scenarios to enhance their clinical learning (Kassutto et al., 2021). Under the umbrella term of simulation, it also includes activities such as standardized patient encounters. Standardised patients are individuals who are trained to portray or role model an injury or illness of an actual patient and are frequently used in athletic therapy education (Armstrong & Jarriel, 2015; Cuchna et al., 2019b). The use of both simulation and standardised patients in athletic therapy education has increased considerably over the past two decades. Armstrong et al., (2024) stated that most of their educator respondents reported using stimulation-based learning, demonstrated by the growing evidence that learning is contextual, thus is clinical reasoning. Role modelling from educators, expert clinicians and simulation are imperative to make metacognitive thinking more visible for students (Schraw, 1998). Hence a top down approach is needed, whereby educators' knowledge, understanding and application of metacognition is required. In addition, a bottom up approach is needed, whereby students' metacognitive skills are "exercised, strengthened and consolidated" (Kuhn, 1999 p.24).

2.3.9.2 Deliberate Practice

Deliberate repeated practice enables students to return to the same task a number of times, allowing previously learned knowledge to become consolidated over time (Karpicke et al., 2009; Schmidt & Mamede, 2020). This enables clinicians' and students to problem solve more effectively by more efficient recall of mental schemas and feedback on performance. This occurs when the individual actively searches and retrieves specific information from their memory, discriminating between different alternatives, creating differential diagnoses of a patient's problem (Pintrich, 2002), subsequently maximising learning and performance

(Guraya, 2016; Koufidis et al., 2020). Educators should encourage students to practice repeatedly and deliberately and request feedback on their performance to enhance and maximise learning (Newsom et al., 2022). The role of the educator/preceptor is critical in providing feedback to improve procedural knowledge. However, some students may not perceive and understand deliberate retrieval practice as a strategy that promotes learning and long-term retention. As a result, some students may not practice it and subsequently will not self-test their knowledge and use their metacognitive skills to generate feedback on their learning, thus not enhancing their learning (Karpicke et al., 2009).

2.3.9.3 Interleaving and Spacing

Interleaving, or mixed practice, is a method in which students shift between various different subjects or topics when studying for examinations (Stanton et al., 2021). For example, in medical and healthcare education students will start studying lower limb anatomy, followed by physiology and finally, biomechanics related to the lower limb. Initially this form of learning may be slow for students where they are comparing and contrasting, but it results in better retention and application of knowledge (Schmidt & Mamede, 2020). When students "space" or leave time between studying the same material or topics, over multiple study sessions, it requires them to intentionally plan what to study. Interleaving helps support students to space their study and focus on learning one material before moving onto another (Stanton et al., 2021).

2.3.9.4 Reflection

Reflective practice allows students to think about their performance, identify any errors or mistakes made and help devise a plan to improve their performance before the next assessment (Langdon et al., 2019). There are a number of ways in which students can

participate in reflective practice, which supports meaningful consideration of actions and thinking (Richards et al., 2020). Self-reflective journaling exercises were supported by athletic therapists for aiding clinical reasoning and metacognition during clinical residencies (Hofmann et al., 2022). However, reflective writing is not intuitive for most, hence support and training may be required for students so they can effectively engage with it. In the Lambe et al. (2016) systematic review of cognitive interventions to enhance clinical reasoning, the impact of guided reflection on clinical reasoning accuracy was examined, showing some positive effectiveness and modest evidence to recommend them to educators. Students who struggle with reflecting on their own academic performance and learning will typically possess poorer metacognitive awareness, hence strategies that improve reflection are critical (Tuononen et al., 2022). Reflective note writing was highlighted as a beneficial tool in consolidating learnings from clinical exposure, invoking critical thought and analysis, promoting professionalism (Agarwal & Rawekar, 2020) and increasing self-confidence in their abilities (O'Loughlin & Griffith, 2020; Tanner, 2012). Additionally, reflective dialogues between the educator and the students allow for deep and meaningful reflection to occur through asking and answering questions, allowing for reflective feedback to be given to the student (Rivas et al., 2022). Interestingly, Versteeg et al. (2021) stated that assessments drive learning and incorporating more reflective journals may be a good way of integrating metacognitive skills into assessment performance. Many metacognitive strategies are based on a reflective capacity and are a good reference for educators to ensure they have reflective activities built into their teaching strategies (Rivas et al., 2022).

Exam wrappers are also a good way to enhance students' reflective metacognitive abilities, where surveys are given to students post examinations which requires them to evaluate their performance and describe how they might change their study or learning

techniques in the future (Gamby & Bauer, 2022). Exam wrappers significantly increased students' knowledge of cognition ($p = 0.01$) (Langdon et al., 2019). Similarly, post examination feedback is a powerful way for students to identify their knowledge gaps and reflect on their learning in general (Medina et al., 2017). Due to time constraints of both educators and students, this feedback can be given to the class as a group or individually. In addition, the muddiest point uses reflection, whereby students identify areas of knowledge that are still causing confusion (Medina et al., 2017). By asking a question such as "what is the most confusing material or aspect to the class?" quickly highlights to the educator the areas that need further explanations and teaching. It also highlights the supportive learning environment students are engaging in, whereby they can articulate their confusions, generating dialogue in class and outside, and into the next class (Tanner, 2012).

2.3.9.5 Socratic questioning

Socratic questioning uses open-ended questions that stimulate metacognitive reflective thinking (Delany & Golding, 2014). Examples include: What went well in the clinical encounter? What did not go well? Describe other ways you could have done that? What made you choose that way? What other options could you have chosen and why? (Burton et al., 2019). These questions can be embedded into teaching assessments such as assignments, exams or used formatively within the classroom (Medina et al., 2017; Tanner, 2012). Educators should avoid closed-ended questions, instead ask "why" and "how" as they are more explorative and encourage more dialogue and justification for answers, utilising the think-aloud approach (Richards et al., 2020). Although the above questions may seem very simplistic, Delany & Golding (2014) argues that students need to practice with simple and refined questions so they can master more complex cases using expert-like intuitive reasoning as they advance in their education. Educators should encourage students' curiosity and questioning through supportive

dialogue (Newsom et al., 2022). Structured debriefing sessions post clinical encounters are beneficial to aid students' engagement in metacognitive thinking through self-reflection and dialogue with preceptors and educators relating to their clinical reasoning. Equally, asking pre-assessment questions is helpful for both educators and students in identifying prior knowledge and promoting metacognition. A sample question could be "What do I already know that could guide my thinking or learning?" (Tanner, 2012).

2.3.9.6 Scaffolding

Literature describes "scaffolding" as an instructor-led teaching method that breaks-down tasks and activities to aid students' learning that would otherwise prove difficult without such support from educators (Masava et al., 2022). Scaffolding provides students with increasingly more difficult tasks to complete as students' progress in their learning. It has been shown to be effective in many different aspects of learning, such as comprehension, communication skills, academic literacy, evidence-based practice and clinical reasoning (Masava et al., 2022). Scaffolding activities were perceived as successful by nursing and medical students during qualitative analysis in steering them towards good clinical reasoning and patient care (Visser et al., 2020). Despite its benefits, Masava et al. (2022)'s integrative review of scaffolding activities highlighted only 2 studies were related to allied health from 29 full text articles reviewed, whereby 17 were related to nursing, 5 medicine, 2 pharmacy and 3 interprofessional education, resulting in the need for future research in this area.

Scaffolding can include metacognitive prompts and checklists that educators can use to help reduce students' cognitive load and processing, while stimulating focused thoughts. In a review of metacognitive teaching strategies used by science educators, 74.5% used metacognitive prompts in their classes (Zohar & Barzilai, 2013). Checklists, rating scales and

rubrics are beneficial scaffolding activities whereby students can monitor and evaluate their thinking as they are working (Medina et al., 2017). Concept maps are commonly used by students to schematically represent and scaffold their knowledge in graphical illustrations (Daniel et al., 2019; Ellis et al., 2014; Pintrich, 2002; Speicher et al., 2012). For example, students can create a concept/mind map of common clinical presentations of various pathologies and injuries in a particular anatomical area (Khin-Htun & Kushairi, 2019). The diagrams present the mental connections and associations of the students' knowledge which is typically displayed on a flipchart/whiteboard or can also be presented digitally. It helps students to explicitly document their understanding and knowledge and provides educators with a powerful tool to observe students' cognitive organisation, identifying conceptual areas they are or are not familiar with (McMillan, 2010). Joshi et al. (2022) found the concept mapping intervention did not significantly enhance class performance either in-person or online ($p > 0.05$), however, 78% of students were optimistic about the usefulness of concept mapping while 84% were inclined to apply it to their learning. SNAPPS (summarise, narrow, analyse, probe, plan and select) is an educational tool used by students to summarise history findings, narrow down the differential diagnoses, analyse the differential, probe for uncertainties, plan the management and select an issue for self-directed study (Heinrichs et al. (2013). It is an effective way to communicate patients' findings by demonstrating clinical reasoning in a time efficient way. This encourages students to scaffold their thinking and consider their thought processes more systematically. Heinrichs et al. (2013) found that SNAPPS improved clinical reasoning, whereby they were better able to summarise case key findings better than the control group ($p <0.001$), thus enhancing their declarative knowledge.

2.3.9.7 Self-explanations and self-testing

Self-explanations are an active learning strategy that involves creating explanations to oneself as you learn content, relating this new knowledge by repeating it in your own words (Schmidt & Mamede, 2020). It is an inexpensive and effective way to ensure students are metacognitively engaged, making their reasoning explicit and elaborate to their peers and educators (Pintrich, 2002). However, when educators are designing such activities, ensuring that clinical case studies are challenging is of utmost importance for prior knowledge and utilisation of case pattern recognition thinking to occur (Chamberland & Mamede, 2015; Medina et al., 2017). In conjunction with this, facilitating elaborative discussions on subject matter with peers or educators further aids learning (Schmidt & Mamede, 2020). Chamberland et al. (2011) found that students in the self-explanation group demonstrated better clinical diagnostic performance compared with the control group, in less familiar topics ($p < 0.05$). The student generated reasoning tool is a resource that asks learners to propose and justify clinical hypotheses and findings, and critically appraise the information related to the clinical problem (Zagury-Orly et al., 2022). This tool is used to help students justify their clinical reasoning. Students were five times more likely to get relevant questions correct if they were in the student-generated reasoning tool group in comparison to the control group ($p < 0.001$) (Zagury-Orly et al., 2022). This justification of reasoning allows students to be made aware of their knowledge and to generate the "why" and "how" questions, promoting higher order thinking and deep learning to occur (Zagury-Orly et al., 2022).

Self-testing is a method where students answer practice questions in an attempt to recall information, by activating prior relevant knowledge, monitoring their understanding and identifying gaps in knowledge (Stanton et al., 2021). Multiple choice questions (MCQ's), extended matching questions (resemble MCQ's but contain longer list of potential answers)

and key feature examinations (key features which are case specific in diagnosing a particular injury/illness) can be used by students as methods of self-testing and checking where knowledge deficits are, thus allow for remediation to occur once feedback is given to show any incorrect answers (Daniel et al., 2019; Guraya, 2016). Modified essay questions are useful where students must document a decision in a free-text (essay) format before moving on (Daniel et al., 2019). Script concordance tests also allow students to examine short clinical scenarios where students must answer a series of questions; if you were thinking X for diagnosis, but then found Y, your hypothesis then is rated on a scale of the likelihood of it occurring (Daniel et al., 2019). This facilitates students to reflect and evaluate their knowledge based on their initial answer and seek to address their next answer. Additionally, high frequency, low stake tests in class are designed to discourage rote learning and cramming for exams (Cutrer et al., 2021), as students become familiar with self-testing. Judgements of understanding is a method which provides students with opportunities to prospectively predict scores of an exam or retrospectively make judgements and rate their confidence in their answer, helping students to self-test, monitor and evaluate their learning (Medina et al., 2017; Stanton et al., 2021). The accuracy of this metacognitive monitoring will influence their studying techniques, thus affecting academic performance (Pintrich, 2002; Stanton et al., 2021). Post examinations, metacognitive evaluation will assess the effectiveness of their learning strategies and overall learning. Pilegard & Mayer (2015) examined judgements of understanding in college students and found large and significant correlations between metacognitive ratings and transfer performance (how well do you understand the topic) ($r = .62$, $p < .001$) and retention performance (how well do you remember) ($r = .59$, $p < .001$). Therefore, teaching metacognitive strategies to students is imperative to aid learning and performance.

Unsurprisingly, in the literature, the teaching strategies outlined to foster clinical reasoning are the same for metacognition. This is a result of metacognition being a foundational way of thinking across all domains and is interwoven into clinical practice. This is particularly evident in the Cooper et al. (2021) consensus statement on clinical reasoning curricula in undergraduate medical education, where they outlined the most effective teaching strategies for clinical reasoning, which were the same techniques used for facilitating metacognition. Therefore, educators become facilitatory guides in an ongoing co-discovery of learning with students, emphasising active learning strategies that foster independent and lifelong learning (Cutrer et al., 2021).

2.4 Metacognition in Higher Education

2.4.1 Athletic therapy education

Athletic therapy education is evolving and mirroring the demands of professional competencies required by the profession and other allied healthcare professions (Hofmann et al., 2022). Commonly in athletic therapy education, programmes blend teaching didactically with clinical practice opportunities so that students can be ready for independent clinical practice (Burton et al., 2019). Most typically, in athletic therapy education, students are frequently expected to acquire knowledge through passive listening, while on the other hand expected to master and develop hands-on practical skillsets, supported by instructor-led laboratories (King & MacKinnon, 2019). Moreover, many athletic therapy educators do not have formalised educational backgrounds in teaching and learning and thus, are unaware of the best pedagogical strategies to use with students to enhance learning. Unsurprisingly, King & MacKinnon's (2019) examination of Canadian athletic therapy educators pedagogies found that

educators' who described greater pedagogical knowledge were more open to different teaching strategies, such as more active-based learning inclusive of flipped classroom and cooperative learning activities. This demonstrates a growth mindset, encouraging a student-centred approach to teaching (Richardson et al., 2021). Furthermore, in this study, most educators identified themselves firstly as athletic therapists and secondly as educators, leaving many to learn on the job in how to teach athletic therapy education. Hence, athletic therapy educators need to be cognizant of the different pedagogical strategies available and the change in medical education shifting from traditional didactic pedagogies to more competency based and innovative strategies, where upskilling by professional development training in this area may be required to address any knowledge gaps (King & MacKinnon, 2019). In addition, if we analyse the Athletic Training Education Journal (at the time of writing), which is deemed to be the principal journal for education in this profession, there is not one paper that explicitly examines metacognition in athletic therapy education, with only 39 papers alluding it to in some capacity as a cognitive process. Similarly, the Journal of Athletic Training also fails to examine metacognition explicitly.

2.4.2 Clinical placements

Learning that occurs in a clinical context is foundational in the education and training of allied healthcare professionals, as it intends to prepare students for the professional demands typically experienced by clinicians (Kosior et al., 2019; Nordquist et al., 2019). The central component of clinical education has, and always will be, experience (Dewey, 1916; Geisler & Lazenby, 2009). Due to the professional competency requirements for all allied healthcare professionals, including athletic therapy, clinical exposures and clinical immersive placement experiences are of paramount importance (Barrett et al., 2018). While medical and allied healthcare curricula instructs students how to take a patient history, perform a physical

examination and generate differential diagnosis, students largely learn and consolidate this learning while on clinical placement (Cooper et al., 2021). Knowledge and clinical practice are strongly interconnected as knowledge is both sustained and manifested through clinical practice (Kump et al., 2015). Hence, equipping our students to think in a variety of contextual rich clinical settings is of utmost importance to enhance intellectual and professional growth and is a core principle in formal athletic therapy undergraduate curricula (Geisler & Lazenby, 2009).

Clinical placement provide students with irreplaceable experiential learning allowing students to apply their cognitive and metacognitive skills in real-time, examining and evaluating the patient and making professional judgements and decisions that will directly impact the patient's care (Khin-Htun & Kushairi, 2019; Kosior et al., 2019). Furthermore, building upon past learning experiences allows learners to construct new knowledge. This was evident in emergency department physicians clinical reasoning, which was underpinned by their knowledge construction on clinical placements (Pelaccia et al., 2020). Therefore, clinical placements should be provided to students early on in their curricula through frequent exposures in order to aid in their clinical reasoning skills. This allows students to discuss patient outcome measures with preceptors and educators, broadening and deepening students' experiential learning and their metacognitive thinking skills (Geisler & Lazenby, 2009).

Clinical placement settings contribute to the development of cognitive flexibility under the right circumstances as each new clinical setting presents challenges and different skills that need to be developed. It helps to improve students' and preceptors' self-regulative abilities (Teunissen et al., 2021). Hence, educators must foster a culture whereby students are supported in their learning to develop, evaluate and reflect upon their own metacognitive thinking (Geisler & Lazenby, 2009). This will occur when students learn through guided instruction and

experience (Ellis et al., 2014), becoming more skilled detectives at identifying the pertinent key features of a clinical problem and using metacognitive thinking skills to aid this. Guided practice facilitated by educators and preceptors allows students to work more independently, a critical component of being an autonomous clinician. The role of the preceptor is central to the student learning experience during clinical immersive placement experience. Therefore, the development of preceptor's knowledge in educational and metacognitive strategies could be beneficial in enhancing students' thinking skills and helping them engage more meaningfully with it (Burton et al., 2019).

2.4.3 Considerations to implementing metacognition into higher education

As healthcare rapidly evolves to the changing needs of patients and diseases, educational curricula requirements need to also evolve over time (Khanna et al., 2021). A criticism of medical and allied healthcare education is the emphasis on attaining clinical knowledge and skills and not teaching students how to think (Shea & Chan, 2024). An important educational objective in higher education is that students should develop various ways of thinking (Golding, 2019), as many workplaces and industries seek graduates that are creative, agile, adaptive, critical thinkers for tomorrow's world. Therefore, enabling students to think metacognitively about their learning; what content needs to be learned, what do I know already, how will I be assessed, is of paramount importance, as in becoming an allied healthcare profession, the learning continues, post-graduation.

If metacognition is to make its way into healthcare education, policy making bodies must make the explicit decision to include it as part of best practice for teaching and learning in higher education, (Georghiades, 2004; Zohar & Barzilai, 2013). This may require changing educators' perceptions or practice of critical higher order thinking skills (Zohar & Barzilai,

2013). In addition, both students and educators need to change their view on learning, so that the process is as important as the outcome of learning (Wall & Hall, 2016), which may require more time allocated to metacognitively reflecting and making alterations to enhance teaching and learning in higher education. Educators should be cognisant when implementing a new pedagogical tool into curricula, that they do not try to domesticate it, moulding it into a more familiar or traditional way of teaching (Zohar, 2006). There is very strong evidence that supports teaching metacognitive skills across all educational levels, as it has positive effects on students' overall academic performance while using metacognitive instruction ($r = 0.69$, $p < 0.01$) (Dignath et al., 2008; Perry et al., 2019). Thus, suggesting metacognition is an indispensable part of education (Avargil et al., 2018). While most students acquire metacognitive knowledge and skills at differing levels of proficiency (Azevedo, 2020), three fundamental learning conditions are required to achieve this: 1) embedding metacognitive instruction into curricular content so that students start to make those metacognitive connections, 2) informing students of the benefits and usefulness of metacognitive activities for academic success and performance, and 3) providing educator training to ensure smooth and maintained metacognitive uptake with activities (Azevedo, 2020; Zohar & Barzilai, 2013).

The explicit embedment of metacognition into programmes and faculties is needed rather than a once-off application (Langdon et al., 2019). Placing an emphasis on metacognition with children from as young as 4-6 years old when starting school is strongly encouraged, to enhance performance and understanding of one's performance (Schraw & Moshman, 1995). Hence, the emphasis should remain and be further augmented throughout all students' schooling inclusive of higher education. In addition, positioning metacognitive activities early on in higher education programmes will help facilitate this, as students will be most receptive to changes in learning at this early stage of their study (Cale et al., 2023; Versteeg et al., 2021).

Furthermore, identifying the level of metacognitive knowledge a student possesses is necessary for developing educational interventions that will be effective, as sometimes educators assume students' knowledge based on their year of study, how they have progressed in assessments or engagement in the programme (Richmond et al., 2020). However, despite the literature recommending the embedment of metacognition into curricula programmes, there are no best practice guidelines published on how to enable educators to do this effectively and to ultimately impact their students' learning positively.

2.4.3.1 Resources and support

Despite much literature clearly detailing the benefits of metacognition in the classroom, traditional pedagogies of knowledge transmission still exist (Zohar & Ben-Ari, 2022; Zohar & Lustov, 2018). Equipping educators with professional metacognitive training is of paramount importance (Wilson & Bai, 2010; Zohar & Ben-Ari, 2022). Professional development should improve and deepen educators' knowledge of metacognition and identify best practices for teaching metacognition (Ozturk, 2017), through collective participation. Additionally, clear goal setting, reflection and active learning should be facilitated to allow educators opportunities to observe experts in this area. In addition, Zohar & Lustov (2018) highlighted that educators not only expressed a lack of metacognitive knowledge as an issue, there was a lack of pedagogical training also. Educators were not familiar with how to teach different components within a class. Hence, education on pedagogical development (McCorkle, 2021; Zohar & Ben-Ari, 2022), will provide a space for sharing ideas and support, to overcome these barriers (VanWyngaarden et al., 2024). As a result of enhanced education for educators, a cultural change in higher education may occur whereby advocacy and support for metacognition sees lasting change (McCorkle, 2021). Professional development in metacognition can bridge the gap between theory and practice (Zohar & Ben-Ari, 2022). However, pedagogical training of

higher education educators may be mandatory in some universities or countries (Vreekamp et al. 2023), but this is not the case in most Irish universities, to the best of our knowledge. Thus, pedagogical development initiatives are necessary and play a significant role in stimulating and engaging educators in upskilling.

With any new implementation or alteration to practice, faculty and educators' perceptions, feelings and motivations must be considered (VanWyngaarden et al., 2024). Educators' may be concerned about the logistics of adopting and executing the new teaching practice (e.g. time taken and needed to implement, available resources etc.) and the impact it may have on student learning (measuring the effectiveness of new teaching practice). In addition, educators may be sceptical about implementing metacognition into their teaching practice, which may be more evident in more traditional transmission-type teachers (Wass et al., 2023). Of note, educators who are unmotivated and not concerned about improving their personal teaching practice or impacting their students' learning, will not seek out professional development opportunities, or see the value or meaning nor participate in them (VanWyngaarden et al., 2024).

Common barriers preventing educators from implementing metacognition within their classes are a lack of support from fellow educators and management, appropriate resources, time constraints and inadequate supports Gamby & Bauer, 2022). In addition, other factors such as overloaded curricula, higher student numbers, growing administration load in academia and higher research expectations may prevent the embedment of metacognition (Wass et al., 2023). Educators need to be encouraged and supported to upskill which will require time, funding, educational resources and an acknowledgement from the universities of the importance of developing the teaching skills of educators. This can only be achieved if specific

funding allocations are in place to educate the educators to upskill and should be viewed as a priority by university management.

2.4.3.2 Cultural and environmental considerations

Social metacognition or socially shared metacognition is when students come together in small groups to share ideas with peers and invite peers to evaluate their ideas, providing a supportive learning environment and opportunities (Stanton et al., 2021). This same concept can be applied to educators to facilitate a common shared language about metacognition and to the larger university community in establishing and embedding metacognition within the university educational goals and objectives. When metacognition is integrated and woven into all aspects of the classroom and the larger university, as a whole, it becomes the normal everyday shared language that educators and students use (Koufidis et al., 2020; Pintrich, 2002; Tanner, 2012). Fostering an environment in which students discuss their own thinking and learning is needed through the integration of metacognition into the general discourse of the programme (Versteeg et al., 2021). This open and supportive environment can positively influence and change students' goal orientations, their metacognitive abilities and their motivations to learn (Siqueira et al., 2020). There needs to be a cultural shift in the way clinical education is taught in athletic therapy, moving away from educator or instructor centred to student-centred learning (Heinerichs et al., 2013), whereby educators become the facilitators and not the 'sage on the stage' (King, 1993). Integrating students' interest and choice through active engagement in an attractive and appealing curriculum helps foster metacognition as a part of a programme's learning environment (Ellis et al., 2014). This adjustment of curriculum can have profound effects on the quality and quantity of teaching instruction and student engagement (Ellis et al., 2014). Furthermore, **t**he development of communities of practice empower educators to continue to improve their teaching and learning by collectively

discussing and sharing ideas related to their teaching practice (Zohar, 2006). This is essential if this change to teaching practice is to last and grow into the future, as change can be difficult and slow. This desire for change and growth is evident in educators and institutional management who adopt a growth mindset to support students who are proficient at continuously growing in their learning, truly fostering lifelong learning (Richardson et al., 2021).

2.4.3.3 Role of the student

The role the student takes in the classroom is very important in how successful new innovative teaching techniques will be, alongside their own personal responsibility and ownership for their learning. There are a number of ways in which students can assist with their learning success, including having a growth mindset and becoming an independent self-regulated learner (Dennis & Somerville, 2022; Richardson et al., 2021; Versteeg et al., 2021). Student engagement is critical and those with a growth mindset can recognise its importance for continual personal and professional development. Having a growth mindset compliments many of the metacognitive thinking skills students, educators and clinicians in athletic therapy should possess. A growth mindset can allow students to see failures as part of the development course of learning and a method of improving their competence, thus promoting a curiosity and willingness to reflect and ask questions (Richardson et al., 2021). In addition to a growth mindset, students need confidence in order to engage with new or challenging learning tasks and to persist with it (Schraw et al., 2006). Students need to be provided with time to allow them to reflect, enhancing their metacognitive awareness overall (Tuononen et al., 2022). Students may not be very motivated to engage with developing their metacognition as they may have been previously rewarded for their passive participation in classes across their schooling (Ben-David & Orion, 2013). There is a challenge to help students

realise this and educate them on best practices for learning (Stanton et al., 2021). The perspectives, personal attitudes and attributes that students and educators bring into the classroom is critical to the overall motivation, readiness and engagement in metacognitive learning (Richards et al., 2020). Due to the nature of higher education, where independent learning is strongly encouraged, developing metacognitive skills, such as self-regulation, is imperative for students' learning success and lifelong learning (Dennis & Somerville, 2022). As stated by Versteeg et al. (2021 p.2), self-regulated students are "captains of their learning." Hence, the integration, embedment and fostering of students' metacognitive thinking as part of the everyday discourse of the classroom is needed to enhance learning now and into the future.

2.5 Summary

The development of higher-order cognitive skills, such as metacognition, is needed for self-directed and lifelong learning skills, which are deemed critical for a career as an athletic therapist and other allied healthcare professionals. Currently, no research exists examining the role of metacognition within athletic therapy education in Ireland, with very limited information pertaining to the profession internationally. In addition, no research has explored athletic therapy students' and educators' awareness and knowledge of metacognition and the implementation of teaching strategies to aid in this development. If educators expect future clinicians to display these critical professional attributes of competence and eventual expertise, they must be explicitly taught, promoted and assessed during didactic and experiential learning experiences, as it is not a guarantee that they will develop autonomously in all students. This development of thinking and learning skills should be a priority for all in allied healthcare, including the athletic therapy profession, as it contributes to clinical reasoning capability, adaptive expertise, and the ability to reason well in future clinical situations where the situation is novel, or the context is unfamiliar and complex. However, a gap remains in the professional

development pedagogical training of educators in how to teach and assess metacognitive strategies and its subsequent impact on student learning and academic success. As a result, no best practice guidelines exist in how to teach and assess metacognition effectively to students in higher education and in particular, athletic therapy education. Therefore, further comprehensive research is required.

Chapter 3. Methodological design and Research Philosophy

Chapter 3: Methodological Approach and Research Philosophy

3.1 Introduction

Considering the research aims and objectives outlined in chapter 1, and adding to the literature review in chapter 2, chapter 3 provides an outline of my research philosophy and methodological approaches to the research studies undertaken. All research paradigms have a set of beliefs that influence how research is studied, conducted and interpreted (Illing & Carter, 2018). As a result, the ontological and epistemological philosophical perspectives of the researcher underpins the research methodology (Illing & Carter, 2018). Ontology is the study of being, the existence and nature of reality (Illing & Carter, 2018; Willig, 2019). Epistemology refers to the theory of knowledge, its origins, limitations and individual's understanding of how knowledge is acquired, perceived and processed (Lunn Brownlee et al., 2017; Willig, 2019). In education, epistemology relates to learning, motivation, reasoning and academic performance (Bientzle et al., 2014), and the influence of how educators instruct and teach (Lunn Brownlee et al., 2017). These philosophical perspectives determine assumptions about what is known and reality (Illing & Carter, 2018) and subsequently informs individuals practice (Willig, 2019). As an educator and researcher, translating theory into practice underpins my philosophical beliefs which inherently impacts my professional practice, alongside addressing the research gaps identified in chapter 2. As a result, the methodological approaches carried out in this research are supported by a pragmatic research philosophy, with the aim of creating practical and meaningful research in athletic therapy education.

3.2. Research philosophy

Pragmatism is centred on knowledge construction that emphasises applied real-life solutions to research questions (Giacobbi et al., 2003), guided by practical experience (Robson

& McCartan, 2016). Pragmatic approaches in healthcare are strongly aligned with clinical reasoning, decision-making and patient outcome measures for optimal patient care (Glasgow, 2013). For me as a researcher and an educator, teaching clinical and practical hands-on skills to athletic therapy students, I strongly identify with a pragmatic research approach. Pragmatism seeks to answer real-world research, by adopting a realist stance in answering "how" and "why" questions (Robson & McCartan, 2016). Answering these types of questions form the basis of clinical reasoning and metacognitive skills and are imperative for key contributors involved in athletic therapy education and practice. Applied real-world research underpins the current programme of study undertaken and seeks to examine the lived experiences that help evaluate, apply learning, and inform decision-making that is evidence-based (Robson & McCartan, 2016).

From a research perspective, pragmatism does not require a particular research method to be completed, but rather encourages researchers to use methods that answer the research questions (Feilzer, 2010). This highlights that context and meaning are at the core of pragmatism (Giacobbi et al., 2003). This is very evident in both my clinical and educational practice, whereby appreciating contextual considerations is critical for successful outcomes for both patients and students. As a result, pragmatic approaches that are relevant and feasible in contextually rich real-world environments are needed for success to be achieved (Glasgow, 2013; Glasgow & Riley, 2013). Pragmatism seeks the middle ground by using a common-sense approach to problem solving and placing high value on the human experience, where knowledge is constructed and based on the realities of the world we live and experience (Robson & McCartan, 2016). My views firmly align with Dewey (1938), who stated that "every experience should do something to prepare a person for later experiences of a deeper and more expansive quality. That is the very meaning of growth, continuity, reconstruction of

experience."(p.47) Pragmatists believe that knowledge is explicitly linked to experience (Allemang et al., 2022). This philosophical view is essential for athletic therapy education in my opinion, as clinical experience and immersion plays a significant role in the training of undergraduate students. John Dewey, an educational philosopher, was a strong advocate of experiential learning, where education happens through experience and action (Dewey, 1938; Dolan et al., 2022). I firmly believe that through experiences individuals can learn and continue to learn.

As a pragmatic researcher, I am interested in gaining knowledge and advancing the athletic therapy profession here in Ireland, while also being passionate about improving methods to enhance my students' learning, particularly in clinical reasoning. This stems from my desire as an educator to be student-centred in my teaching approach. As a result, I believe educators need to be mindful of the students in their classrooms and develop a greater understanding in how they learn, to facilitate them becoming confident and competent athletic therapists. This may require educators to be flexible and adaptable in the way that they teach. It also requires educators to be reflective on their educational practice. Pragmatists support the need for reflection as a consequence of scientific inquiry (Giacobbi et al., 2003), and as a result, I try to emphasise and model how important reflection is to my students.

I relate to the term pracademic (Dickinson et al., 2020), that encompasses my background as a former practicing athletic therapist who is now in higher education/academia. Pracademics have a blend of teaching styles that focus on practical application to theory and academic knowledge (Dickfos, 2019). As an educator, I incorporate evidence-based theoretical knowledge into clinically meaningful practice for my athletic therapy students. A fundamental skill for athletic therapists and allied healthcare professional students is the ability to critically appraise current available research evidence and translate it into clinical practice to enhance

patient outcomes (Welch Bacon et al., 2021). In doing so, pragmatism underpins my educational and research practice.

3.3. Selecting research strategies

Pragmatism supports the utilisation of different methods of inquiry to address a scientific problem in the most appropriate way, using different methods as tools to aid in our methodological understanding (Allemang et al., 2022). "The choice of research methodology is made by balancing the approach that best answers the research question against the feasibility of completing the study" (Ratelle et al., 2019 p.26). There is no perfect methodology, as each one has its limitations and biases (Ratelle et al., 2019). The methodological selection in this research is supported by a pragmatic application, allowing the selection of methods that are suitable to answer the research question (Foster, 2024). For successful pragmatic measures, they should be broadly applicable (Glasgow & Riley, 2013), hence transferability is central to a pragmatic approach. Transferability is a process of applying information drawn from one context to another that has not been previously studied (Drisko, 2025). Due to the complex, nuanced and multifactorial nature of both clinical reasoning and metacognition, the use of all three research paradigms, namely quantitative, qualitative and mixed methods, were used to fully explore my research questions. Pragmatic measures must be meaningful and of value to practitioners (Glasgow & Riley, 2013), so for the context of this research, the methodological approaches used needed to be suitable to address both educators and students involved in this research.

Considering the limited number of research articles examining metacognitive awareness in allied healthcare professionals and students, and no research findings existing in athletic therapy, it was imperative to first understand the level of metacognitive awareness in

athletic therapy students enrolled in ARTI-accredited universities in Ireland. As a result, I chose to use the validated MAI, a quantitative survey utilised in past research (Schraw, 1998; Schraw & Dennison, 1994). This investigation was expanded to evaluate whether year of study, completion of immersive clinical placement experiences, or gender impacted athletic therapy students' metacognitive awareness, as described in Chapter 4. Following this, the next part of the research investigated educators' awareness, understanding and implementation of metacognitive teaching strategies within their practice, using a mixed-method approach as outlined in chapter 5. Mixed-method design allows researchers to appreciate and complete research using both quantitative and qualitative research paradigms (Illing & Carter, 2018), allowing for a holistic approach, supported by a pragmatism philosophical underpinning (Giacobbi et al., 2003; Robson & McCartan, 2016). I chose to adapt and combine two quantitative surveys utilised in past research (Dennis & Somerville, 2022; Tanner, 2012), and apply them to an Irish allied healthcare higher educational context. This investigation examined self-reflective metacognitive questions about educators current teaching practice and the implementation of metacognitive teaching strategies. In addition, semi-structured interviews were conducted to gain a deeper understanding of educators' understanding and lived experiences of and exposures to metacognition while delivering athletic therapy programmes in Ireland. In chapter 6, a qualitative study examined educators' barriers and facilitators to implementing metacognitive teaching strategies in allied healthcare education. Therefore, applying a pragmatic approach to this research was needed, whereby an open-minded and balanced position was required (Foster, 2024). Considering the overall goal of this research was to generate meaningful evidence to support educators and enhance student learning, this approach was the most appropriate.

3.3.1. Semi-structured interviews

Semi-structured interviews were utilised in Chapters 5 and 6 to explore educators' perceptions and experiences of metacognition, including barriers and facilitators to implementation, within athletic therapy education. Semi-structured interviews are the most frequently used qualitative data collection method in medical education research (Ng et al., 2013). Semi-structured interviews blend both open- and closed-ended questions in a conversational format that allows for follow-up of "how" and "why" questions to be asked (Adams, 2015). This is particularly relevant when exploring the depth and breadth of educators' understanding, experiences, barriers and facilitators of implementing metacognition into their teaching practice. The use of semi-structured interviews provides perspective, meaning, and context (Robson & McCartan, 2016), supporting a pragmatic approach to gain rich and in-depth personal participant experiences and perspectives (Ng et al., 2013). The personal attributes of the researcher is an important consideration for qualitative research whereby possessing an open and enquiring mind, being a good listener, being knowledgeable of the topic area, and being adaptive and flexible is favoured (Adams, 2015; Robson & McCartan, 2016). Interview guides were developed for the semi-structured interviews in Chapters 5 and 6 and served as a checklist for the interviewer to follow. However, they also allow for flexibility to ask additional and follow up questions as needed (Cristancho et al., 2018; Ng et al., 2013; Robson & McCartan, 2016). As noted by Adams (2015), they should be considered a work in progress and subject to change. In this research, the interview guides allowed for flexibility by reordering of questions if needed, based on the participants' responses and prompting participants' if follow up questions were required.

3.3.2 Trustworthiness

Ensuring trustworthiness is essential in the credibility and reliability of qualitative research (Ahmed, 2024; Stenfors et al., 2020). Trustworthiness in qualitative research refers to validity (accuracy of a result) and generalisability (general applicability) (Robson & McCartan, 2016). Fundamentally, the extent to which the data accurately reflects the views and experiences of the participant is a critical aspect of qualitative research (Ahmed, 2024). To enhance the rigour and trustworthiness of this research, the 'critical friend' approach was utilised. Critical friends are those that ask provocative questions, viewing research data through a different lens, offering a different perspective and criticality to a researcher's work (MacPhail et al., 2024; Mat Noor & Shafee, 2021). Critical friends provide support and stimulate reflection, a key component of qualitative research (MacPhail et al., 2024). Critical friends were engaged in the research investigation at different phases, including a fellow healthcare educator experienced in qualitative research who contributed to the creation of the interview guides and qualitative data analysis, as well as educators experienced in metacognition and athletic therapy/training education who contributed to the development and peer review of the recommendations in chapter 7.

Reflexivity is defined as a "set of continuous, collaborative, and multifaceted practices through which researchers self-consciously critique, appraise, and evaluate how their subjectivity and context influence the research processes" (Olmos-Vega et al., 2023 p.242). Reflexivity is an essential aspect of qualitative studies and is intertwined into the researcher's subjective perspectives (Olmos-Vega et al., 2023). Reflexivity depends on the researcher's rigorous and truthful self-scrutiny (Birnbaum, 2025), to self-reflect and continuously be self-aware, which are essential attributes of metacognition. To facilitate my reflexivity during this research investigation, I met regularly with my supervisory team to discuss my research and

after each meeting I would use this time to de-brief, self-reflect, document our discussions and put a plan in place. Reflexivity is a continuous process of self-reflection aided by meeting regularly with team members for reflexive discussion (Barrett et al., 2020). In addition, to facilitate my reflexivity throughout the qualitative stages of this research, during the semi-structured interviews I took field notes which helped form my interpretations of the data during the data analysis stage.

3.4 Summary

This chapter demonstrates and highlights my pragmatic philosophy as an educator and researcher. In addition, it highlighted my philosophical beliefs to translate metacognitive theory into practice and create practical and meaningful research and practice in athletic therapy education. Furthermore, this chapter described the selection of the research strategies used for each of the three investigations that sought to address the research's aims and objectives, in accordance with a pragmatic approach. The methodological details for each of the three investigations are outlined in Chapters 4-6 can be found in the Methods sections of the subsequent three chapters.

Chapter 4: Metacognitive Awareness among Learners Enrolled in Athletic Therapy Programmes in Ireland.

Chapter 4: Metacognitive Awareness among Learners Enrolled in Athletic Therapy Programmes in Ireland.

Allen L, O Connor S, O'Keeffe S, Whyte E (2025). Metacognitive Awareness Among Learners Enrolled in Athletic Therapy Programmes in Ireland. *Journal of Athletic Training Education and Practice*. 2025;21(2):107-114. doi:10.4085/1947-380X-24-067

4.1 Abstract

Context: Metacognitive awareness is a higher-order cognitive process that allows learners to regulate, reflect and evaluate knowledge, and identify strengths and weaknesses to improve performance. Metacognitive awareness provides a framework for the development of effective clinical reasoning, which is a core competency in the practice of athletic therapy and consequently a critical component of athletic therapy education. Clinical reasoning is an essential skill for athletic therapy students to develop especially during clinical encounters. To date, the level of metacognitive awareness remains unknown in undergraduate athletic therapy students studying in Ireland. *Objective:* To examine metacognitive awareness in undergraduate athletic therapy students. *Design:* Cross-sectional survey. *Patients or Other Participants:* Undergraduate athletic therapy students enrolled onto Athletic Rehabilitation Therapy Ireland (ARTI) accredited programmes. *Data Collection and Analysis:* Athletic therapy undergraduate students in Ireland (n=233) completed the 52-item Metacognitive Awareness Inventory. *Results:* There was a strong positive correlation between total knowledge of cognition and total regulation of cognition ($r = 0.69$, $p < 0.001$). Athletic therapy students from all four years of their undergraduate degree demonstrated moderately good metacognitive awareness as measured by the total metacognitive awareness inventory (183.9 ± 49.0). No significant differences in metacognitive awareness for year of study or gender were observed. Learners

that had not yet completed a clinical immersive placement had significantly higher metacognitive awareness than those who had ($p = 0.03$). *Conclusion:* Metacognitive awareness among athletic therapy students is lower when compared to other healthcare student cohorts. Clinical immersive placements provide opportunities to develop clinical knowledge and skills in a supportive environment for students and enhance metacognitive awareness. Action should be taken to improve teaching metacognitive awareness to athletic therapy students in Ireland.

4.2 Introduction

Clinical reasoning skills are of critical importance to all healthcare professionals, including athletic therapists, as they allow clinicians to integrate cognitive, psychomotor, and affective skills to diagnose, manage, and treat a patient's medical needs in a given context (Cooper et al., 2021; Daniel et al., 2019; Gordon et al., 2022; Huhn et al., 2019; Yazdani & Abardeh, 2019). Clinical reasoning requires lower-order and higher-order cognitive processes. Metacognitive awareness is a higher-order cognitive process consisting of two main components: a) knowledge of cognition and b) regulation of cognition. Knowledge of cognition is the awareness of how we learn, our ability to learn, and the effectiveness and efficacy of learning (Rivas et al., 2022; Schraw, 1998; Wilson & Bai, 2010). Regulation of cognition is the conscious ability to control and manage learning through monitoring and evaluation (Schraw, 1998; Schraw & Moshman, 1995; Wilson & Bai, 2010). Metacognitive awareness allows "individuals to plan, sequence, and monitor their learning in a way that directly improves performance"(Schraw & Dennison, 1994 p.460).

Metacognitive awareness provides a structured approach for clinicians and students to use and consequently is associated with better patient care (Asadzandi et al., 2022; Kosior et

al., 2019; Newsom et al., 2022; Siqueira et al., 2020; Wang et al., 2023). Metacognitive awareness allows athletic therapy students to develop their thinking to be more expert-like by regulating, reflecting, and evaluating their knowledge and learning, identifying gaps in their knowledge, and taking the remedial action needed to address this (Medina et al., 2017; Tuononen et al., 2022; Wilson & Bai, 2010). This facilitates students to become more cognitively aware (Kosior et al., 2019); enhancing their ability to adapt to unpredictable and complex clinical situations (Cale et al., 2023).

Metacognitive awareness has been investigated in healthcare students, predominantly in medicine and nursing, whereby undergraduate students in these disciplines typically had poor metacognitive awareness, which potentially contributed to poor academic grades and performance (McCabe, 2011; Medina et al., 2017). This may have been due to a reliance on rote learning, memorization, and surface learning techniques that were not sufficient for metacognitive awareness to develop (Joshi et al., 2022). As a result, students may have grossly overestimated their performance in comparison to experts (Dunning et al., 2003; Kruger & Dunning, 1999). Metacognition is improved by using metacognitive teaching strategies in the classroom such as think-aloud, reflections, and concept mapping (Joshi et al., 2022; Medina et al., 2017; Tanner, 2012). Therefore, supporting educators to facilitate the development of metacognitive strategies to aid student's metacognitive awareness is of paramount importance (Versteeg et al., 2021; Wilson & Bai, 2010).

Traditionally in Ireland, athletic therapy education programmes have facilitated the development of clinical reasoning through practical clinical skills with semester-long clinical immersive placements, in the final year (year 4) of the undergraduate programmes. Immersive clinical placements provide an important role in experiential learning; learning by doing and

reflecting on an experience or past experiences. They play a significant part in the development of metacognitive awareness and clinical reasoning (Khin-Htun & Kushairi, 2019; Kosior et al., 2019; Kuhn, 1999), developing both psychomotor and cognitive skills in a controlled and supervised way (Geisler & Lazenby, 2009). Learning that occurs in a clinical setting allows social, cultural, and contextual elements of clinical reasoning to develop, thus enhancing metacognitive skills (Kosior et al., 2019; Nordquist et al., 2019). To the authors knowledge, the examination of metacognitive awareness in athletic therapy students' enrolled in Athletic Rehabilitation Therapy Ireland (ARTI) programmes has not been studied to date. It is unknown if students develop better metacognitive awareness as they progress through their formal education. The aims of this study are to 1) examine undergraduate athletic therapy students' metacognitive awareness and 2) explore whether year of study, completion of immersive clinical placement experiences, or gender impacts athletic therapy students' metacognitive awareness.

4.3 Methods

4.3.1 Participants and study design

A cross-sectional study was conducted and undergraduate athletic therapy students studying in Ireland were recruited. Participants were eligible if they were over the age of 18 years old, and studying undergraduate athletic therapy in an ARTI accredited third level institution. Ethical approval was granted by the DCU Research Ethics Committee. Students were required to read a plain language statement and provide informed consent prior to completing the survey. A sample size calculation indicated a requirement of 199 athletic therapy students studying in Ireland. The calculation was completed with the confidence level set at 95% and the margin of error set at 5%, using an online sample size calculator. (http://www.raosoft.com/samplesize.html)

4.3.2 Instrumentation

An anonymous 62 question survey was utilised. Section one examined demographic information including gender, year of study, educational history, student status (i.e., mature student or not, with a mature student classified as those over the age of 23 years at the commencement of their undergraduate degree) and completion and setting of clinical immersive placement. Section two examined metacognitive awareness using the Metacognitive Awareness Inventory (MAI) (Schraw & Dennison, 1994), a 52-item, self-reported inventory (Table 4.1). It consisted of two subscales; knowledge of cognition (17-items) and regulation of cognition (35-items) with eight defined subcategories. Knowledge of cognition was categorised into procedural (4-items), declarative (8-items), and conditional (5-items). Regulation of cognition included the subcategories of planning (7-items), information management strategies (10-items), monitoring (7-items), debugging strategies (5-items) and evaluation (6-items). For each item, participants rated their response, using a 5-point Likert scale, and indicated how true or false each statement related to them, ranging from 1- Always False to 5- Always True. Responses were summated to give a total MAI (ie., TMAI) with a maximum achievable score of 260 (Harrison & Vallin, 2018). The higher the scoring on the MAI, the better the individual's metacognitive ability (Schraw & Dennison, 1994). The Cronbach's alpha coefficient for TMAI (0.82), knowledge of cognition (0.78) and regulation of cognition subscales (0.82) demonstrated good internal consistency.

Table 4.1: Metacognitive Awareness Inventory

Metacognitive Awareness Inventory				
Please use the rating scale provided to respond to each question below by indicating how true or false each statement is about you				
1- Always False, 2- Sometimes False, 3- Neutral, 4 - Sometimes true, 5- Always True				
Domain Code		**Domain ID**	**MAI Questions**	
Knowledge of Cognition	**Declarative Knowledge (DK)**	DK1	Q5:	I understand my intellectual strengths and weaknesses.
		DK2	Q10:	I know what kind of information is most important to learn.
		DK3	Q12:	I am good at organizing information.
		DK4	Q16:	I know what the teacher expects me to learn.
		DK5	Q17:	I am good at remembering information.
		DK6	Q20:	I have control over how well I learn.
		DK7	Q32:	I am a good judge of how well I understand something.
		DK8	Q46:	I learn more when I am interested in the topic.
	Procedural Knowledge (PK)	PK1	Q3:	I try to use strategies that have worked in the past.
		PK2	Q14:	I have a specific purpose for each strategy I use.
		PK3	Q27:	I am aware of what strategies I use when I study.
		PK4	Q33:	I find myself using helpful learning strategies automatically.
	Conditional Knowledge (CK)	CK1	Q15:	I learn best when I know something about the topic
		CK2	Q18:	I use different learning strategies depending on the situation.
		CK3	Q26:	I can motivate myself to learn when I need to.

		CK4	Q29:	I use my intellectual strengths to compensate for my weaknesses.
		CK5	Q35:	I know when each strategy I use will be most effective.
Regulation of Cognition	**Planning (P)**	P1	Q4:	I pace myself while learning in order to have enough time.
		P2	Q6:	I think about what I really need to learn before I begin a task.
		P3	Q8	I set specific goals before I begin a task.
		P4	Q22:	I ask myself questions about the material before I begin.
		P5	Q23:	I think of several ways to solve a problem and choose the best one.
		P6	Q42:	I read instructions carefully before I begin a task.
		P7	Q45:	I organize my time to best accomplish my goals.
	Information Management Systems (IMS)	IMS1	Q9:	I slow down when I encounter important information.
		IMS2	Q13:	I consciously focus my attention on important information.
		IMS3	Q30:	I focus on the meaning and significance of new information.
		IMS4	Q31:	I create my own examples to make information more meaningful.
		IMS5	Q37:	I draw pictures or diagrams to help me understand while learning.
		IMS6	Q39:	I try to translate new information into my own words.
		IMS7	Q41:	I use the organizational structure of the text to help me learn.
		IMS8	Q43:	I ask myself if what I'm reading is related to what I already know.
		IMS9	Q47:	I try to break studying down into smaller steps.
		IMS10	Q48:	I focus on overall meaning rather than specifics.
	Monitoring (M)	M1	Q1:	I ask myself periodically if I am meeting my goals.
		M2	Q2:	I consider several alternatives to a problem before I answer.

		M3	Q11:	I ask myself if I have considered all options when solving a problem.
		M4	Q21:	I periodically review to help me understand important relationships.
		M5	Q28:	I find myself analysing the usefulness of strategies while I study.
		M6	Q34:	I find myself pausing regularly to check my comprehension.
		M7	Q49:	I ask myself questions about how well I am doing while I am learning.
	Debugging Strategies (DS)	DS1	Q25:	I ask others for help when I don't understand something.
		DS2	Q40:	I change strategies when I fail to understand.
		DS3	Q44:	I re-evaluate my assumptions when I get confused.
		DS4	Q51:	I stop and go back over new information that is not clear.
		DS5	Q52:	I stop and reread when I get confused.
	Evaluation (E)	E1	Q7:	I know how well I did once I finish a test.
		E2	Q19:	I ask myself if there was an easier way to do things after I finish a task.
		E3	Q24:	I summarize what I've learned after I finish.
		E4	Q36:	I ask myself how well I accomplish my goals once I'm finished.
		E5	Q38:	I ask myself if I have considered all options after I solve a problem.
		E6	Q50:	I ask myself if I learned as much as I could have once I finish a task.

DK – Declarative Knowledge, PK- Procedural Knowledge, CK – Conditional Knowledge, P- Planning, IMS – Information Management Systems, M – Monitoring, DS- Debugging Strategies, E- Evaluation.

4.3.3 Procedures

The survey was administered online (Qualtrics, Provo, UT) and was open from the 2nd February 2023 to 31st March 2023. The survey was advertised by word of mouth, social media and distributed to the programme chairs of all three ARTI accredited universities via email for distribution to all their undergraduate athletic therapy students (Years 1-4).

4.3.4 Data analysis

Responses were downloaded from Qualtrics and analysed using Statistical Package for the Social Sciences (SPSS; Version 28). Data was screened for missing data or invalid responses. Frequencies and descriptive statistics were examined from the eligible responses, including the mean, minimum, maximum, total score and standard deviation. Means and standard deviations of each of the 8 subcomponents of metacognition were calculated. A total overall score for knowledge of cognition (TKC) and regulation of cognition (TRC) were summated and total mean overall score (TMAI) was calculated. Normality was examined and data was found to be non-normally distributed.

Spearman's product correlation coefficient was conducted to examine the relationships between the main components of metacognition (TKC and TRC). The strength of the relationship was identified as small (r = 0.10-0.29), medium (r = 0.30- 0.49) or large (r = 0.50-1.0) (Cohen, 1998). Kruskal-Wallis tests were conducted to examine differences between the years of study and TMAI, TKC and TRC scores. Mann-Whitney U tests analysed differences between completion of a clinical immersive placement and gender for TMAI, TKC and TRC scores. Effect sizes were classified as small (r = 0.2), medium (r = 0.5) and large (r = 0.8) (Cohen, 1998). Significance for statistical tests was $p \leq 0.05$.

4.4 Results

4.4.1 Participant demographics

Two hundred and ninety-three undergraduate athletic therapy students studying in Ireland opened the survey. Sixty were excluded due to incomplete responses (ie., completed only demographic data) as answering questions throughout the questionnaire were not mandatory. Thus, 233 participants were included in the analysis, representing a response rate of 56% from all eligible athletic therapy students. Participant demographics are presented in Table 4.2. A similar proportion of men (45.5%) and women (54.5%) completed the survey. A comparable number of students in Year 2 (26.2%), 3 (31.3%) and 4 (26.2%) participated in the study respectively, of which 8.2% were mature students.

Table 4.2 - Descriptive Statistics

		Percent (%), Frequency (n)
Gender	Man	45.5 (106)
	Woman	54.5 (127)
	Non-binary	0.0 (0)
	Prefer not to say	0.0 (0)
	Other	0.0 (0)
*Type of Previous Education Prior to Studying Undergraduate Athletic Therapy	Leaving Certificate	81.5 (190)
	National Framework Qualification Level 6	11.6 (27)
	National Framework Qualification Level 7	3.4 (8)
	National Framework Qualification Level 8	2.1 (5)
Year of Study	Year 1	16.3 (38)
	Year 2	26.2 (61)
	Year 3	31.3 (73)
	Year 4	26.2 (61)
Mature Student	Yes	8.2 (19)
	No	91.8 (214)
Completion of Year 4 Semester-long Clinical Immersive Placement	Yes	35.2 (82)
	No	64.8 (151)

Location of Completion of Immersive Placement	Ireland	9.9 (23)
	America	5.6 (13)
	UK	3.4 (8)
	EU	0.85 (2)
	Australia	0.85 (2)
	Total	20.6 (48)
Settings for Clinical Immersive Placement	Clinical	29.6 (69)
	Pitch-side	33 (77)
	Sport Organisation	18.5 (43)
	Hospital	0.4 (1)
	Occupational	0.0 (0)
	Military	0.4 (1)
Placement Integrated into a Module	Yes	54.5 (127)
	No	40.3 (94)

*The National Framework of Qualifications has ten levels of qualifications available in Ireland. Leaving Certificate is level 5, typically awarded following two years of full-time education, prescribed by the Department of Education and Science. Level 6 has advanced and higher certificates. Level 7 is an ordinary bachelor degree. Level 8 is an honours bachelor degree. (*QQI National Framework of Qualifications.*, 2021)

4.4.2 Total metacognitive awareness inventory

The overall TMAI score was found to be 183.9 ± 49.0. A summary of the mean MAI scores and all eight subcomponents of metacognitive awareness are presented in Table 4.3. There was a significant and positive correlation between TKC and TRC ($r = 0.69$, $p < 0.001$). No statistically significant difference was evident across the four years of study in athletic therapy for TMAI scores ($p > 0.05$).

Significantly higher TMAI scores with a small effect size were observed in those that did not complete a clinical immersive placement (Md = 3.67) compared to those who did (Md = 3.51, $p = 0.03$, $r = 0.17$). There was no significant difference between completion of placement and TKC scores ($p > 0.05$). No significant differences in the TMAI scores between men and women were noted ($p > 0.05$). No significant gender differences were observed for TKC scores and TRC scores ($p > 0.05$).

Table 4.3: Scoring of Metacognitive Awareness Inventory (MAI) Questions.

Scoring of Metacognitive Awareness Inventory (MAI) Questions by Subcomponents	N	Mean ± SD	Total Mean ±SD	Range*
Total Declarative Knowledge	225	3.7 ± 0.5	29.8 ± 7.5	1.4 – 5.0
Total Procedural Knowledge	225	3.6 ± 0.6	14.4 ± 3.6	2.0 – 5.0
Total Conditional Knowledge	223	3.6 ± 0.5	18.0 ± 4.6	2.0 – 4.8
Total Planning	200	3.3 ± 0.6	23.0 ± 7.0	1.7 - 4.7
Total Information Management	204	3.6 ± 0.5	36.2 ± 9.6	2.2 – 4.8
Total Monitoring	203	3.4 ± 0.5	23.4 ± 6.5	2.1 – 4.6
Total Debugging Strategies	225	3.8 ± 0.5	19.2 ± 4.5	2.4 – 5.0
Total Evaluation	194	3.3 ± 0.5	19.9 ± 5.8	2.0 – 4.8
Total Knowledge of Cognition (TKC)	215	3.7 ± 0.4	62.2 ± 15.7	2.1 – 4.9
Total Regulation of Cognition (TRC)	159	3.5 ± 0.4	121.7 ± 33.3	2.3 – 4.4
Total Metacognitive Awareness Inventory (TMAI)	159	3.6 ± 0.4	183.9 ± 49.0	2.3 - 4.5

*Range: 1: Strongly False – 5: Strongly agree

Note: The total mean scores of each of the 8 subscale components of the MAI, overall total knowledge of cognition (TKC) and overall total of regulation of cognition (TRC) and overall Total metacognitive awareness inventory (TMAI) scores were calculated.

4.5 Discussion

Metacognitive awareness is a critical skill for athletic therapy clinicians. Therefore, it is incumbent on athletic therapy educators to develop this skill in athletic therapy students. No previous research has examined metacognitive awareness in undergraduate athletic therapy students studying in Ireland or how it is influenced by year of study, completion of semester-long clinical immersive placement or gender. Our study found that athletic therapy students studying in Ireland during all four years of their undergraduate degree demonstrated moderately good metacognitive awareness, with TMAI score of 183.9 ± 49.0, TKC scores of 62.2 ± 15.7 and TRC scores of 121.7 ± 33.3 respectively.

The MAI scores in this current study are lower compared to other undergraduate healthcare professional student cohorts in psychology and nursing respectively (TMAI scores = 192.13 ± 16.63, TKC = 63.15 ± 6.34, TRC = 128.99 ± 12.49) (Rivas et al., 2022), (TMAI scores = 189.76 ± 20.04, TKC = 61.71 ± 6.60, TRC =128.05 ± 13.76) (Chan et al., 2021). Due to different reporting procedures evident in the literature, mean metacognitive awareness scores were also examined in this current study (TMAI = 3.6 ± 0.4, TKC = 3.7±0.4, TRC = 3.5 ± 0.4). The mean metacognitive awareness scores in this current study were comparable to social and humanity undergraduate students (TKC = 3.75 ± 0.58, TRC =3.12 ± 0.67) (Tuononen et al., 2022) and higher than undergraduate psychology students (TMAI = 3.48 ± 0.53, TKC = 3.61±0.56, TRC = 3.39 ± 0.55) (Jang et al., 2020). The lower scores in TMAI, demonstrated slightly poorer overall metacognitive awareness ability in our present study, resulting from lower regulation of cognition. This is suggestive of a poorer ability to regulate metacognitive components such as planning, monitoring and evaluating (Table 4.3). The ability to self-regulate is a key component in lifelong learning (Kuhn, 2000), and is an essential skill required for a career in athletic therapy as an autonomous healthcare professional. Overall, poorer

metacognitive awareness can result in ineffective study strategies thus impacting academic performance and clinical success and expertise (Cale et al., 2023; Medina et al., 2017).

4.5.1 Facilitating metacognitive teaching strategies

Athletic therapy programmes in Ireland should be reviewed to consider where metacognitive strategies can be effectively implemented. Educators need to be familiar with the appropriate teaching methods to facilitate metacognitive awareness (Zohar & Barzilai, 2013). This should allow students to take active participatory roles in their learning, both inside and outside the classroom to enhance learning. Knowledge of cognition and regulation of cognition can be improved with the use of teaching strategies that have been proven to be effective (Medina et al., 2017; Tanner, 2012). These include think-aloud protocols, reflection, judgements of understanding (asking learners to make prospective or retrospective judgements on their learning), problem-based learning, concept mapping, exam wrappers (reflective questions posed pre and post assessments), and structured debriefing prompts (What went well in the clinical encounter? What didn't go well? Next time, what would you do differently?) (Avargil et al., 2018; Schraw, 1998; Zohar & Barzilai, 2013). In this study, regulation of cognition values were lower in comparison to Rivas et al. (2022) and Chan et al. (2021) findings in psychology and nursing students. Regulation of cognition can be specifically improved by the implementation of strategies that promote substantial reflective evaluation such as case-based learning and standardised patients/simulation. These teaching strategies allow educators and clinical preceptors to ask reflective and debriefing questions so that students can identify gaps in their knowledge and remediate these gaps through planning and goal setting tasks. This facilitates students' regulatory control of their learning (Kosior et al., 2019; Spruce & Bol, 2015; Versteeg et al., 2021; Zimmerman, 2002).

Our research observed no differences in metacognitive awareness between the four different years of study, similar to a study by Welch et al., (2018) in medical students. This is contrary to what many educators and researchers expect; i.e. metacognitive awareness develops as students' progress through their formal education. This may be suggestive of insufficiently developed metacognitive awareness (Kuhn, 1999), resulting in students needing to be explicitly taught metacognition. The development of metacognitive awareness is proposed to start early in life and continues into adolescence and adulthood (Kuhn, 1999, 2000; Schneider, 2009; Schraw & Moshman, 1995), and becomes more explicit and effective under the conscious control of the learner as they age (Kuhn, 2000). However, these metacognitive skills can remain incompletely developed, resulting in poor metacognitive awareness (Kuhn, 1999). Students need to be consciously aware of how to think about their thinking and be able to manage it (Kuhn, 2000). Metacognition is an essential educational tool to do this. Educators also need to be cognizant to explicitly teach it in their curricula as an essential cognitive skill (Versteeg et al., 2021), to prevent a theory to practise gap from occurring (Dennis & Somerville, 2022), whereby the theory of metacognition exists evidently in the literature, but may not be practised within the classroom setting, to optimise student learning (Schraw, 1998).

No gender differences in metacognitive awareness were observed in this study, suggesting that there is no need to adapt metacognitive teaching strategies based on gender. In the past, literature has been inconsistent and inconclusive regarding the examination of gender and metacognitive awareness (Abdelrahman, 2020). In addition, metacognition is a very individualised process in which educators must be cognizant of providing students many different metacognitive strategies to aid their own individualised development of metacognitive awareness.

4.5.2 Clinical immersive placement and metacognitive awareness

Learners in this study that had not yet completed a clinical immersive placement, displayed significantly higher TMAI than those that did, with a small effect size. Further analysis revealed no significant differences in knowledge of cognition and regulation of cognition between the groups. The results are surprising, as one would expect the immersive experiential learning experience to enhance metacognitive awareness, as reflective practice is an essential component to athletic therapy practice and metacognition. Many questions remain as to what type of reflective practice is being practised by athletic therapy students; is it superficial reflection or deep and meaningful reflection? And even more critically, are the students actively engaging in this process to further develop their metacognitive awareness?

The clinical immersive placement is embedded into athletic therapy curricula to support students in their development of knowledge and skills in preparation for autonomous clinical practice post certification, through the supervision of preceptors (Calvert et al., 2024; Eldred et al., 2021). Clinical placement is more than an act of doing, it should also include cognitive and metacognitive strategies to aid student learning (Edler et al., 2019). Unsurprisingly, the role of the preceptor is fundamental to clinical immersive placement through role modelling and mentoring of students, however many preceptors indicated a lack of training which may limit its benefit (Eldred et al., 2021). To date, no research has examined preceptors' metacognitive awareness and the role it plays during the supervision of clinical immersive experiences. Furthermore, the totality of evidence on clinical immersive placement in athletic therapy is very limited whereby, Cavallario & Singe, (2025) stated the effects on learning and skill development is yet unknown. Moreover, to the authors best knowledge, this is the first study to examine metacognitive awareness and clinical immersive placements, hence future studies are required to investigate this further.

There is a responsibility for educators and clinical preceptors to model their own metacognitive awareness by being metacognitive role models (Wall & Hall, 2016). This can be demonstrated in a number of ways such as through think aloud and reflective discussions, by describing their thought processes explicitly for students to develop these metacognitive skills. Students may have difficulty reflecting on their own learning processes or have a lack of knowledge of their own strengths and weaknesses in regard to learning, ultimately affecting the strategies they could use to improve their learning (Schraw, 1998; Tuononen et al., 2022). Students must be adequately equipped, guided and taught what metacognitive learning strategies are, and how, when, and why to implement them (Tuononen et al., 2022; Wilson & Bai, 2010). This should be completed in both the classroom and during clinical immersive placement experiences. This will foster learning environments that promote metacognitive awareness (Schraw, 1998).

4.5.3 Limitations

There are some limitations to this study. Firstly, the use of self-reported questionnaires (MAI) have limitations such as social desirability bias and central tendency bias (Craig et al., 2020; Harrison & Vallin, 2018). This may have led to issues with honesty and accuracy of responses. As metacognition is not directly observable, there is a need for self-reporting measures such as the MAI to measure metacognitive awareness, limiting researchers to a small number of suitable ways to measure metacognitive awareness such as the MAI. Convenience sampling was used in this study, however, a large response rate of 56% was recorded. This study examined athletic therapy undergraduate students studying in Ireland only, thus limiting the generalisability of the results to other healthcare students and some athletic therapy students internationally.

4.5.4 Future directions

Future research should explore post-baccalaureate athletic therapy metacognitive awareness. In addition, future research should seek to investigate athletic therapy educators' understanding, knowledge and implementation of metacognitive awareness as an educational framework and toolkit. Future investigations could examine if metacognition is embedded and taught in athletic therapy curricula and the establishment of best practices for implementing and developing metacognitive awareness in higher education. Finally, investigating athletic therapy clinical supervisors' and preceptors' understanding and use of metacognitive awareness during clinical immersive placement experiences is recommended.

4.6 Conclusion

Metacognitive awareness among student athletic therapy learners in Ireland is lower when compared to other healthcare student cohorts. Thus, the explicit teaching of metacognitive strategies in higher education is required to enhance this. There were no significant differences between metacognitive awareness and years of study or gender. Learners that had not yet completed a clinical immersive placement had significantly higher metacognitive awareness than those who had, however the effect size was small. A challenge for researchers and educators alike is how to practically inform and reform educational practice in athletic therapy both nationally and internationally, when the literature on metacognitive awareness is limited in this field.

Summary of Chapter 4 and its link with Chapter 5

The findings of chapter 4 established that undergraduate athletic therapy students studying in Ireland had moderately good metacognitive awareness. Despite this, metacognitive awareness is lower in comparison to other similar allied healthcare students. As a result, it shows that metacognition should be improved and the need to establish what metacognitive teaching strategies are currently used by educators in athletic therapy education. It also highlights the value in explicitly educating and teaching metacognitive strategies to aid student learning, in particular, during clinical immersive experiential learning environments. In order for these findings to have meaningful and practical significance, an exploration of factors that contribute to allied healthcare educators' awareness, understanding, and implementation of metacognitive teaching strategies needs to be explored. Therefore, chapter 5 presents educators' perceptions on this topic.

Chapter 5: Allied healthcare educators' awareness, understanding, and implementation of metacognitive teaching strategies within their practice.

Chapter 5: Allied healthcare educators' awareness, understanding, and implementation of metacognitive teaching strategies within their practice.

Acceptable for publication in the Journal of Athletic Training-Education and Practice pending some minor requested revisions.

5.1 Abstract

Developing metacognition as part of allied healthcare education is of critical importance in ultimately developing students' clinical reasoning skills. Despite the importance of metacognition for academic development, clinical practice and lifelong learning, a theory to practice gap is evident in the literature. Therefore, the aim of this study was to explore allied healthcare educators' awareness, understanding, and inclusion of metacognition in their teaching practice. A mixed-method approach was adopted, using an online questionnaire (n=28) and semi-structured interviews (n=14), with educators teaching on athletic therapy programmes in Ireland. In this study, 67.9% of participants had heard of metacognition, with 54% of educators *always* self-reflecting on how they think their class went. Reflective thematic analysis revealed two themes in educator's awareness and understanding of metacognition; 1) diverse awareness and 2) acknowledgment of the important role of metacognition in allied healthcare education. Three themes constructed from the inclusion of metacognitive teaching strategies were:1) key contributors' role, 2) types of metacognitive strategies, 3) contextual and pedagogical considerations. These findings suggest educators need more robust understandings of metacognition, enhanced by further support and resources to aid the implementation of metacognitive strategies into their practice.

5.2 Introduction

Metacognition is a higher order cognitive process that is essential for clinical reasoning and critical for competent clinical practice (Koufidis et al., 2020; Norman, 2005; Young et al.,

2020). Enhanced metacognition facilitates student learning by enabling students to effectively and efficiently monitor and manage their thinking skills, determine their strengths and weaknesses and allow for remedial action (Schraw, 1998), which can then directly improve performance (Abdelrahman, 2020; Schraw & Dennison, 1994; Stanton et al., 2021). Consequently, metacognition has a very important role in lifelong learning (Cutrer et al., 2021), and ultimately the development of expertise (Magno, 2010). Metacognition should therefore play a critical role in the education of allied healthcare professionals.

Metacognition is linked to how students learn, the learning strategies they use and the transfer of learning from one context to another (Dunlosky & Rawson, 2019; Pintrich, 2002; Winne & Marzouk, 2019), ultimately affecting how students perform academically (Ohtani & Hisasaka, 2018). It is the second most powerful predictor of learning (Wang et al., 1993). An emphasis is placed on independent learning in higher education, with the majority of student learning happening outside of the formal classroom (Dennis & Somerville, 2022). Therefore, student learning needs to shift from a passive role that students are familiar with to an active role with a focus on independent learning. In order for learning to be successful, students must accept personal responsibility and act accordingly (Lumpkin, 2015), however, students require support to do this from educators who can guide students to use effective learning strategies (Cale et al., 2023; Medina et al., 2017; Rivers et al., 2020). Unless students are familiar with these learning strategies, they will not be able to use them (Biwer et al., 2023; Pintrich, 2002). Educators can use metacognitive teaching strategies to facilitate metacognitive awareness by identifying specific knowledge and skills deficits in their students' learning, it also requires educators to reflect on, and modify where necessary, their own teaching to enhance student learning (Versteeg et al., 2021; Wilson & Bai, 2010). Therefore, it is of paramount importance that metacognitive skills are supported and developed in healthcare professional education.

However, despite the reported significance of metacognition in the literature for the past 40 years, its implementation into allied healthcare teaching practice remains largely unknown (Biwer et al., 2023).

The application of metacognitive strategies in the classroom is a powerful tool to aid student learning (Pintrich, 2002). Both Azevedo (2020) and Zohar & Barzilai (2013) recognised that in order for educators to successfully implement metacognition into teaching practice, they first must understand it and know how to teach it by using appropriate metacognitive teaching strategies (Ozturk, 2017; Zohar & Ben-Ari, 2022). Furthermore, educators' understanding of metacognition is related to their self-beliefs and perceptions of their pedagogical understanding of metacognition (Cale & McNulty, 2024; Wilson & Bai, 2010). Despite the known theoretical benefits of metacognition, few studies have examined educators' awareness and understanding of metacognition. According to Dennis & Somerville (2022) and further supported by (Zohar & Ben-Ari, 2022; Zohar & Lustov, 2018), there is a metacognition theory to practice gap in higher education. In fact, science educators metacognitive knowledge was found to be lacking and unsatisfactory for comprehensive teaching of metacognitive thinking skills (Zohar, 2006; Zohar & Barzilai, 2013), whereby 90% of science education teachers examined were unfamiliar with the concept of metacognition (Ben-David & Orion, 2013). This lack of knowledge of metacognition may be due to a lack of formal professional development training of metacognition in higher education (Vreekamp et al., 2023; Wass et al., 2023; Zohar & Ben-Ari, 2022; Zohar & Lustov, 2018b). Very limited studies exist that examine metacognitive practices in medical and allied health educators (Cale & McNulty, 2024). To our knowledge, no research has examined allied health educators' perceptions and implementation of metacognition in higher education. Therefore, the aims of this study were to explore allied healthcare educators' awareness and understanding of

metacognition. Secondly, we aim to examine educators' inclusion of metacognitive strategies in their teaching practice and how they are influenced.

5.3 Methods

5.3.1 Study design

This study adopted a sequential explanatory mixed-method approach consisting of two distinct phases, using an online questionnaire to quantify educators' frequency of metacognition within their teaching practice paired with semi-structured interviews. This mixed-method approach allowed a deeper understanding of educators' understanding and lived experiences of and exposure to metacognition (Rodriguez & Smith, 2018), revealing meanings that could be otherwise hidden, through rich personal and context specific experiences and expertise of educators (Cristancho et al., 2015). All authors are experienced allied healthcare educators working in higher education. Ethical approval was granted by the DCU Research Ethics Committee (DCU/REC/2023/117).

5.3.2 Participants

Allied healthcare educators teaching at least one module on an Athletic Rehabilitation Therapy Ireland (ARTI) accredited third-level athletic therapy programme were recruited using convenience sampling. Participants provided informed consent prior to completing the questionnaire. The questionnaire was distributed to the programme chairs of all three ARTI-accredited institutions via email, for distribution to all their educators teaching on their athletic therapy programme and advertised on social media and word of mouth. At the conclusion of the questionnaire, participants were invited to participate in phase two (follow-up interviews), and thus, were recruited via the same process.

5.3.3 Questionnaire

Phase one was the administration of the questionnaire online (Qualtrics, Provo, UT) and was open from the 7th November 2023 to 22nd December 2023. An anonymous 59-item questionnaire was utilised, composed of three sections (Appendix 8). Section one examined demographic information including gender, age, educational qualifications, years of teaching experience, and teaching discipline, along with participants' awareness of metacognition (yes or no and open-ended response for those who selected yes to detail their current understanding). Section two included the 33-item measure created by Tanner (2012) to promote faculty educator's metacognitive teaching through self-reflective questions (Table 5.1). For each statement, participants indicated how frequently they asked themselves these metacognitive questions about their current teaching practice in an Athletic Therapy programme during an academic semester using a 5-point Likert scale; ranging from 1 (never) to 5 (always). Responses were summated to give a total overall mean score range for educators' self-reflective metacognitive questions in the classroom (TESQ). The higher the scoring, the better the educators' metacognitive self-awareness is to promote metacognition in their teaching practice. Good internal consistency was observed (Cronbach's alpha = 0.82). Section three utilised the 16-item metacognitive supportive practice statements to examine the implementation of metacognitive teaching strategies (Table 5.2) (Dennis & Somerville 2022). Participants indicated how frequently they used each statement by using a 5-point Likert scale; ranging from 1 (never) to 4 (often) with an additional option of "I don't know what this is". Responses were summated to give a total overall mean score range for the implementation of metacognitive teaching strategies (TIMP). The higher the scoring, the more frequent the implementation of the metacognitive teaching strategies occurred. Questionable internal

consistency was observed (Cronbach's alpha = 0.65). The questionnaire took on average 12.0 ± 5.8 minutes to complete.

5.3.4 Semi-structured interviews

Participants for phase two, were invited to take part in a subsequent semi-structured interview conducted online (Zoom Video Communications, Inc., San Jose, CA) by the primary author. A semi-structured interview guide (Appendix 9) with open-ended questions and prompts was developed. The interview guide was underpinned by relevant literature and informed by Dennis & Somerville (2022) and Zohar (2006) and also the authors' knowledge and experience as educators in athletic therapy in Ireland. The semi-structured interviews were piloted on two allied healthcare educators working in Ireland and took 45.0 ± 9.2 minutes to complete. These pilot interviews were used to educate and train the primary author (LA) in efficient interview techniques. The interview guide remained unchanged, and the pilot data was not included in the final analysis. Fourteen semi-structured interviews were conducted between December 2023 and February 2024 with allied healthcare educators teaching on ARTI-accredited programmes. Participants were from a variety of allied healthcare professional backgrounds inclusive of; certified athletic therapists (n=5), chartered physiotherapists (n=4), dual qualified as certified athletic therapist and physiotherapist (n=1), sport scientists (n=2), strength and conditioning coach (n=1) and a sport psychologist (n=1).

The semi-structured interviews were moderated by the primary author, lasted on average 48.5 ± 12.9 minutes and were video- and audio-recorded for subsequent transcription and analysis. The two main overarching research questions asked to participants during the semi-structured interviews were: a) allied healthcare educator's awareness and understanding

of metacognition in higher education in Ireland and b) examining allied healthcare educator's inclusion of metacognition into their teaching practice.

Table 5.1 Educators Self -Reflective Metacognitive Questions about Current Teaching Practice

Educators Self -Reflective Metacognitive Questions about Current Teaching Practice	
Please use the rating scale provided to respond to answer each of the questions below by indicating how frequently you ask yourself these metacognitive questions about your current teaching practice in an Athletic Therapy programme during an academic semester.	
1- Never, 2 - Rarely, 3- Sometimes, 4 – Often, 5- Always.	
Q1	What do I think students already know about this topic?
Q2	What evidence do I have for my thinking?
Q3	How can I make this material personally relevant for my students? Why do I think this?
Q4	What mistakes did I make the last time I taught this?
Q5	How can I not repeat these mistakes?
Q6	Why do I think it's important for students pursing a variety of careers to learn ideas in my module?
Q7	What are my assumptions?
Q8	How does success in this module relate to my student's career goals?
Q9	How might I reveal these connections to them?
Q10	What do I want my students to be able to do by the end of this module?
Q11	What do I want my students to be able to do in 5 years' time?
Q12	What do I notice about how students are behaving during this class session?
Q13	Why do I think this is happening?
Q14	What language or active learning strategies am I using that appears to be facilitating or impeding learning?
Q15	How is the pace of the class going?
Q16	What could I do right now to improve the class session?

Q17	In what ways am I effectively reaching my goals for the students through my teaching?
Q18	How could I expand on these successful strategies?
Q19	In what ways is my approach to teaching in this course not helping students learn?
Q20	How can I change my teaching strategies to address this?
Q21	How is my approach to teaching this module different from the last time I taught it? Why?
Q22	How can I change my teaching strategies to address this?
Q23	How is my approach to teaching this module different from the last time I taught it? Why?
Q24	How do I think today's class session went?
Q25	Why do I think that? What evidence do I have for that?
Q26	How did the ideas of today's class session relate to my previous class session?
Q27	To what extent do I think the students saw these connections from previous to current class?
Q28	How will what I think about influence my preparation for the next time?
Q29	What evidence do I have that students learned what I think they learned?
Q30	What advice would I give students next year about how to learn the most in this module?
Q31	If I were to teach this module again, how would I change it?
Q32	What might keep me from making those changes?
Q33	How is my thinking about teaching changing?

(Tanner, 2012)

Table 5.2 Implementation of Metacognitive Teaching Strategies

Implementation of Metacognitive Teaching Strategies	
Please use the rating scale provided to respond to answer each of the questions below by indicating how frequently you use each of the following metacognitive teaching strategies in your current teaching practice in an Athletic Therapy programme during an academic semester.	
1- Never, 2 - Rarely, 3- Sometimes, 4 - Often, 5- I don't know what this is.	
Q1	Peer assessment using mark criteria I provide.
Q2	Self-assessment using mark criteria I provide.
Q3	Group work where students must explain their thinking/rationale to each other.
Q4	Ask students what they already know about a topic before I teach it.
Q5	Ask students to articulate what they do and/or don't understand about a topic, either verbally or as a written exercise.
Q6	Ask students to consider and evaluate different approaches to solving a problem.
Q7	Encourage students to use checklists or prompts to help them evaluate whether they have correctly answered a problem or understood a concept.
Q8	Explicitly categorise thinking or learning, for example using Bloom's taxonomy of remember, understand, apply, analyse, evaluate, create.
Q9	Student "think-alouds", where I ask students to talk through what they are thinking when they solve a problem.
Q10	Staff "think-alouds", where I talk through my thinking while solving a problem.
Q11	Ask students to predict possible outcomes in an experiment or scenario, then make observations, then explain the outcome.
Q12	Ask students to reflect on how they approached a task or assignment and what they would do differently next time.
Q13	Ask students to rate how confident they are in their answer.

Q14	ConcepTest: I pose a challenging question, students vote on an answer, students discuss, students vote again.
Q15	Draw concept maps, also known as mind maps.
Q16	Explain to students how to separate key issues from less important information, for example in a text or research paper.

(Dennis & Somerville, 2022)

5.3.5 Data Analyses

5.3.5.1 Quantitative analyses

Questionnaire responses were downloaded from Qualtrics and analysed using SPSS (Version 28). Frequencies and descriptive statistics, including means and standard deviations were calculated. A total overall score was calculated from all summated responses for both the educators' self-reflective metacognitive questions in the classroom (TESQ) and the implementation of metacognitive teaching strategies (TIMP). The data was found to be normally distributed. Pearson's product correlation coefficients were conducted to examine the relationships between years of teaching experience and 1) TESQ and 2) TIMP respectively. The strength of the relationship was classified as small (r = 0.10-0.29), medium (r = 0.30-0.49) or large (r = 0.50-1.0)(Cohen, 1998). Independent T-tests were conducted to compare TESQ and TIMP mean scores between 1) gender 2) heard of metacognition and 3) formal teaching qualification. Effect sizes were classified as small (0.2), medium (0.5) and large (0.8) (Cohen, 1998). Significance for statistical tests was $p < 0.05$.

5.3.5.2 Qualitative analyses

The semi-structured interview transcripts were analysed using the six-phased approach for reflective thematic analysis (Braun & Clarke, 2006, 2019). Data was auto-transcribed in Zoom and reviewed for accuracy to allow the researcher's deep immersion into the data and to ensure familiarity prior to data coding. After familiarisation, initial coding was conducted, which allowed the codes to be combined and generated into initial themes. Themes were then reviewed and refined, allowing for hierarchical themes to be developed (Byrne, 2022). After discussion and refinement, the preliminary thematic structure was discussed by the research

team, before the final report was prepared. NVivo14 (QSR International, Melbourne, Australia) was used to analyse the data. Reporting adheres to the Standards for Reporting Qualitative Research (O Brien et al. 2024) checklist (Appendix 10).

The researcher is an experienced athletic therapy educator which brought familiarity and awareness to topics discussed by the participants in each of the interviews. This helped build trust and rapport with participants which supported the breadth and depth of the data collected. A "critical friend" approach was adopted during the analysis with one of the research team to facilitate discussion on additional perspectives and interpretations of the data. Direct quotations are provided (Tables 5.7 and 5.8) as representative statements from participants.

5.4 Results

5.4.1 Questionnaire

A total of 34 educators teaching on athletic therapy programmes in Ireland completed the questionnaire. Six participants were excluded at the screening and cleaning process of the data analysis due partially completed data (i.e., completed only demographic data). Thus, 28 participant responses were included in the analysis, which represents a response rate of 55% from all eligible educators on athletic therapy programmes in Ireland. Participant demographics are presented in Table 5.3. A similar proportion of men (42.9%) and women (57.1%) completed the questionnaire. Participants holding a doctoral degree (PhD or professional doctorate) represented 60.7% of participants, with 50.0% having a Master's degree, while 60.7% had no formal teaching qualification. All participants surveyed taught one or more of the disciplines within Athletic Therapy education, with the exception of pharmacology. In total, 67.9% of participants had heard of metacognition prior to completing the questionnaire.

Table 5.3 Descriptive Statistics

Descriptive Statistics		
		Percent (%), Frequency (n)
Gender	Man	42.9 (12)
	Woman	57.1 (16)
Educational Qualifications (all that apply)	PhD	60.7 (17)
	MSc	50.0 (14)
	PGDip	7.1 (2)
	BSc (Honours)	50 (14)
	Higher Certificate	10.7 (3)
	Other	3.6 (1)
Formal Teaching Qualification	Yes	39.3 (11)
	No	60.7 (17)
Discipline within Athletic Therapy Education	Anatomy	32.1 (9)
	Physiology	25.0 (7)
	Psychology	7.1 (2)
	Biomechanics	21.4 (6)
	Injury Prevention	17.9 (5)
	Nutrition	10.7 (3)
	Neuro-Musculoskeletal evaluation and assessment	46.4 (13)

	Medical conditions and disabilities	7.1 (2)
	Acute Care of Injuries and Illnesses	17.9 (5)
	Therapeutic interventions	32.1 (9)
	Conditioning and Rehabilitative exercises	25 (7)
	Pharmacology	0.0 (0)
	Professional Responsibility and Development	7.1 (2)
Heard of Metacognition	Yes	67.9 (19)
	No	32.1 (9)

The overall TESQ mean score was 3.6. ± 0.3 (Table 5.4). The total TIMP mean score was 2.7 ± 0.4 (Table 5.5). Years of teaching experience was not significantly correlated to either TESQ ($r = 0.31$, $p = 0.14$) or TIMP ($r = 0.07$, $p = 0.71$). No significant difference was observed between formal teaching qualification and participants' knowledge of metacognition (χ^2 [1, n = 28] = 0.15, p = 0.70). No significant gender differences were observed for TESQ scores [t(22)= -0.16, p= 0.88] and TIMP scores [t(26)= 1.5, p = 0.14]. There were no significant differences found between those who had not heard of metacognition and who had heard of metacognition for TESQ scores [t(22)=1.1, p = 0.28] and for TIMP scores [(2.7 ± 0.4), t(26)= 0.06, p = 0.95]. No significant differences were observed between participants who did or did not hold a formal teaching qualification for TESQ scores [t(22)=0.39, p = 0.69] and TIMP scores [(2.7 ± 0.4), t(26)=0.15, p = 0.88].

Table 5.4: Total Educators Self- Reflective Metacognitive Questions of Current Teaching Practice

Educators Self Reflective Metacognition Questions of Current Teaching Practice in the Classroom						
Please use the rating scale provided to respond to answer each of the questions below by indicating how frequently you ask yourself these metacognitive questions about your current teaching practice in an Athletic Therapy programme during an academic semester.						
1- Never, 2 - Rarely, 3- Sometimes, 4 – Often, 5- Always.						
Educators Self Reflective Metacognition Questions of Current Teaching Practice in the Classroom	**Never (%)**	**Rarely (%)**	**Sometimes (%)**	**Often (%)**	**Always (%)**	**Mean ± SD (Range)**
1: What do I think students already know about this topic? (n=28)	0	4	25	39	32	4.0 ± 0.9 (2.0 - 5.0)
2: What evidence do I have for my thinking? (n=28)	0	18	50	32	0	3.1 ± 0.7 (2.0 -4.0)
3: How can I make this material personally relevant for my students? Why do I think this? (n=28)	0	0	25	61	14	3.9 ± 0.6 (3.0 - 5.0)
4: What mistakes did I make the last time I taught this? (n=24)	4	21	25	38	13	3.3 ± 1.0 (1.0 - 5.0)
5: How can I not repeat these mistakes? (n=28)	0	4	14	57	25	4.0 ± 0.7 (2.0 - 5.0)
6: Why do I think it's important for students pursing a variety of careers to learn ideas in my module? (n=28)	0	0	25	57	18	3.9 ± 0.7 (3.0 - 5.0)
7: What are my assumptions? (n=28)	0	0	18	71	11	3.9 ± 0.5 (3.0 - 5.0)
8: How does success in this module relate to my student's career goals? (n=24)	0	25	21	29	25	3.54 ± 1.1 (2.0 - 5.0)
9: How might I reveal these connections to them? (n=24)	0	29	42	29	0	3.0 ± 0.8 (2.0 - 4.0)
10: What do I want my students to be able to do by the end of this module? (n=28)	0	18	18	57	7	3.5 ± 0.9 (2.0 - 5.00
11: What do I want my students to be able to do in 5 years' time? (n=24)	4	13	29	46	8	3.4 ± 1.0 (1.0 - 5.0)

12: What do I notice about how students are behaving during this class session? (n=28)	0	4	7	39	50	4.4 ± 0.8 (2.0 - 5.0)
13: Why do I think this is happening? (n=28)	7	36	25	25	7	2.9 ± 1.1 (1.0 - 5.0)
14: What language or active learning strategies am I using that appears to be facilitating or impeding learning? (n=24)	0	4	17	58	21	4.0 ± 0.8 (2.0 - 5.0)
15: How is the pace of the class going? (n=24)	0	0	42	46	13	3.7 ± 0.7 (3.0 - 5.0)
16: What could I do right now to improve the class session? (n=28)	0	11	14	64	11	3.8 ± 0.8 (2.0 - 5.0)
17: In what ways am I effectively reaching my goals for the students through my teaching? (n=28)	0	7	21	61	11	3.8 ± 0.7 (2.0 - 5.0)
18: How could I expand on these successful strategies? (n=28)	0	11	32	43	14	3.6 ± 0.9 (2.0 - 5.0)
19: In what ways is my approach to teaching in this course not helping students learn? (n=28)	4	7	36	46	7	3.4 ± 0.9 (1.0 - 5.0)
20: How can I change my teaching strategies to address this? (n=28)	0	7	39	54	0	3.5 ± 0.6 (2.0 - 4.0)
21: How is my approach to teaching this module different from the last time I taught it? Why? (n=28)	0	7	46	46	0	3.4 ± 0. 6 (2.0 - 4.0)
22: How can I change my teaching strategies to address this? (n=28)	0	4	43	50	4	3.5 ± 0.6 (2.0 - 5.0)
23: How is my approach to teaching this module different from the last time I taught it? Why? (n=28)	4	4	36	50	7	3.5 ± 0.8 (1.0 - 5.0)
24: How do I think today's class session went? (n=28)	0	0	7	39	54	4.4 ± 0.6 (3.0 - 5.0)
25: Why do I think that? What evidence do I have for that? (n=27)	0	15	19	56	11	3.6 ± 0.9 (2.0 - 5.0)
26: How did the ideas of today’s class session relate to my previous class session? (n=28)	0	0	29	54	18	3.9 ± 0.7 (3.0 - 5.0)
27: To what extent do I think the students saw these connections from previous to current class? (n=28)	0	14	39	36	11	3.4 ± 0.9 (2.0 - 5.0)

28: How will what I think about influence my preparation for the next time? (n=28)	0	14	21	50	14	3.6 ± 0.9 (2.0 - 5.0)
29: What evidence do I have that students learned what I think they learned? (n=28)	0	21	29	50	0	3.3 ± 0.8 (2.0 - 4.0)
30: What advice would I give students next year about how to learn the most in this module? (n=28)	0	7	29	57	7	3.6 ± 0.7 (2.0 - 5.0)
31: If I were to teach this module again, how would I change it? (n=28)	0	0	11	54	36	4.3 ± 0.6 (3.0 - 5.0)
32: What might keep me from making those changes? (n=26)	4	8	35	42	12	3.5 ± 0.9 (1.0 - 5.0)
33: How is my thinking about teaching changing? (n=28)	0	18	39	39	4	3.3 ± 0.8 (2.0 - 5.0)
Total ESQ Score						3.6 ± 0.3

*Range 1: Never – 5: Always

Table 5.5 Total Implementation of Metacognitive Teaching Strategies

Implementation of Metacognitive Teaching Strategies						
Please use the rating scale provided to respond to answer each of the questions below by indicating how frequently you use each of the following metacognitive teaching strategies in your current teaching practice in an Athletic Therapy programme during an academic semester.						
1- Never, 2 - Rarely, 3- Sometimes, 4 – Often, 5- I don't know what this is.						
Implementation of Metacognitive Teaching Strategies	**Never (%)**	**Rarely (%)**	**Sometimes (%)**	**Often (%)**	**I don't know what this is (%)**	**Mean ± SD (Range)**
1: Peer assessment using mark criteria I provide. (n=28)	14.3	28.6	39.3	17.9	0.0	2.6 ± 1.0 (1.0 - 4.0)
2: Self-assessment using mark criteria I provide. (n=28)	7.1	28.6	39.3	25.0	0.0	2.8 ± 0.9 (1.0 - 4.0)
3: Group work where students must explain their thinking/rationale to each other. (n=28)	0.0	3.6	39.3	57.1	0.0	3.5 ± 0.6 (2.0 - 4.0)
4: Ask students what they already know about a topic before I teach it. (n=28)	7.1	3.6	39.3	50.0	0.0	3.3 ± 0.9 (1.0 - 4.0)
5: Ask students to articulate what they do and/or don't understand about a topic, either verbally or as a written exercise. (n=28)	3.6	25.0	39.3	32.1	0.0	3.0 ± 0.9 (1.0 - 4.0)
6: Ask students to consider and evaluate different approaches to solving a problem. (n=28)	0.0	25.0	35.7	39.3	0.0	3.1 ± 0.8 (2.0 - 4.0)

7: Encourage students to use checklists or prompts to help them evaluate whether they have correctly answered a problem or understood a concept. (n=28)	10.7	39.3	32.1	17.9	0.0	2.6 ± 0.9 (1.0 - 4.0)
8: Explicitly categorise thinking or learning, for example using Bloom's taxonomy of remember, understand, apply, analyse, evaluate, create. (n=28)	25.0	39.3	25.0	10.7	0.0	2.2 ± 1.0 (1.0 - 4.0)
9: Student "think alouds", where I ask students to talk through what they are thinking when they solve a problem. (n=28)	25.0	10.7	39.3	25.0	0.0	2.6 ± 1.1 (1.0 - 4.0)
10: Staff "think alouds", where I talk through my thinking while solving a problem. (n=28)	25.0	17.9	28.6	28.6	0.0	2.6 ± 1.1 (1.0 - 4.0)
11: Ask students to predict possible outcomes in an experiment or scenario, then make observations, then explain the outcome. (n=28)	7.1	28.6	28.6	35.7	0.0	2.9 ± 1.0 (1.0 - 4.0)
12: Ask students to reflect on how they approached a task or assignment and what they would do differently next time. (n=28)	3.6	28.6	39.3	28.6	0.0	2.9 ± 0.9 (1.0 - 4.0)
13: Ask students to rate how confident they are in their answer. (n=28)	32.1	28.6	32.1	7.1	0.0	2.1 ± 1.0 (1.0 - 4.0)
14: ConcepTest: I pose a challenging question, students vote on an answer, students discuss, students vote again. (n=28)	50.0	21.4	17.9	10.7	0.0	1.9 ± 1.0 (1.0 - 4.0)
15: Draw concept maps, also known as mind maps. (n=28)	28.6	21.4	39.3	10.7	0.0	2.3 ± 1.0 (1.0 - 4.0)
16: Explain to students how to separate key issues from less important information, for example in a text or research paper. (n=28)	17.9	32.1	17.9	32.1	0.0	2.6 ± 1.1 (1.0 - 4.0)
Total Implementation Score						2.7 ± 0.4 (1.9 - 3.3)

Range 1: Never – 4: Often, 5 -I don't know what this is.

5.4.2 Semi-Structured Interviews

5.4.2.1 Allied healthcare educator's awareness and understanding of metacognition in higher education in Ireland.

The interviews identified two major themes; a diverse current awareness of metacognition and acknowledgment of the important role of metacognition in allied healthcare education, as evident in Figure 5.1.

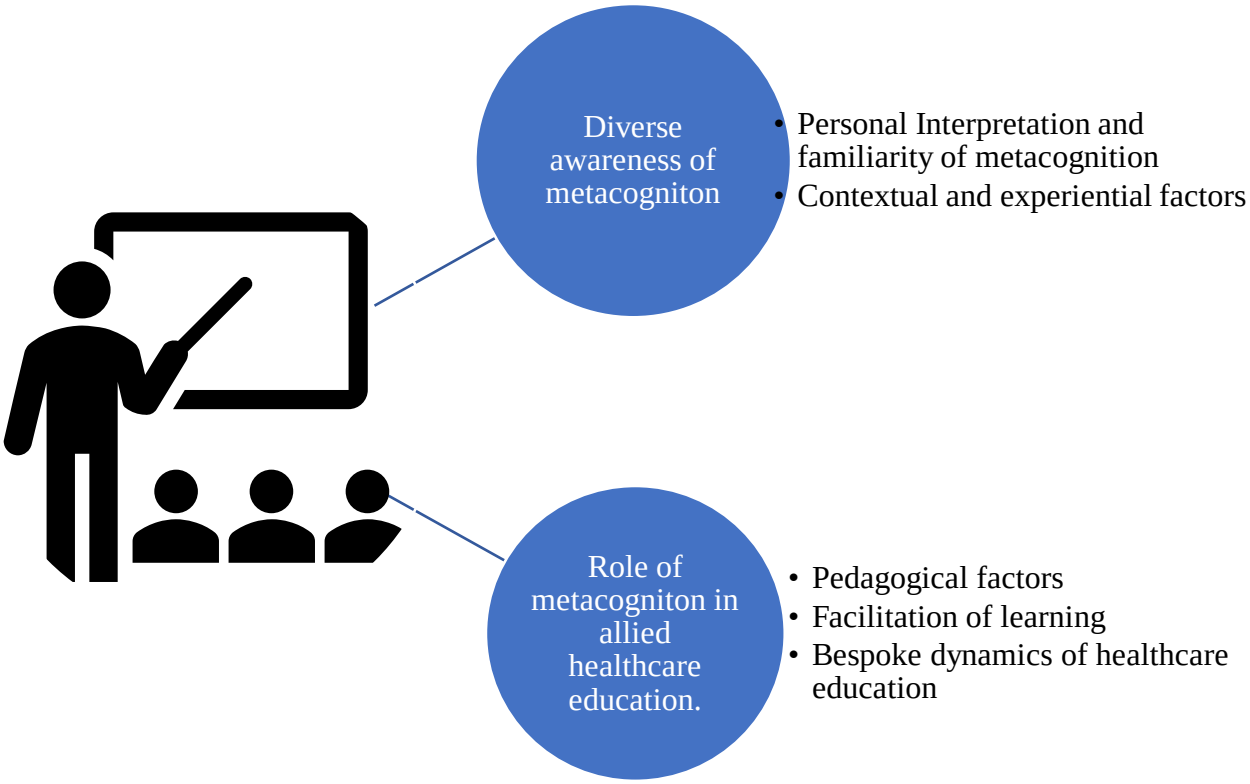

Figure 5.1: Themes and subthemes of allied healthcare educator's awareness and understanding of metacognition.

5.4.2.1.1 Diverse current awareness of metacognition

Participants provided a variety of responses with regard to their awareness and understanding of metacognition, evident when all fourteen participants were asked for their definition of metacognition as highlighted in Table 5.6. Participants expressed that reflection was an important aspect of metacognition and highlighted the intuitive nature of metacognition, a process that occurs subconsciously by individuals. However, participants also identified that metacognition should be more of a conscious activity to benefit students. Some participants reported a lack of awareness and knowledge of metacognition, echoed by some reporting metacognition as being a difficult concept to understand and therefore, very difficult to teach metacognition to students. Despite this, there was an assumption of the importance of metacognition for learning, where some focused on the contextual and experiential factors that affected their awareness and understanding of metacognition, such as their past teaching experiences. Educators personal experience played a large role in this, as some educators mimicked what they knew and had experience of, with the exception of one participant who changed their practice to be more metacognitive as a result of personal self-reflections and feedback from students. Many educators reported a lack of exposure to metacognition, resulting from their inexperience of teaching metacognition and using it in the classroom.

Table 5.6: Definitions of Metacognition by Allied Healthcare Educators

P1: If I go to cognition first... to me that would mean how somebody carries out actions or how they process information… Meta... I don't know... Is meta higher order or large scale?
P2: Metacognition is reflecting or thinking on your own thinking processes and your own thoughts as well. Because I think there are 2 different things. Why do I come up with this? And what was that thought about?
P3: Being aware of your own mental processes when you're thinking and when you're learning, and when you're teaching.
P4: I wasn't actually sure until I did your initial questionnaire. I wasn't aware of the definition.
P5: I would imagine it is the complexity of thinking or taking different sources of information, and trying to consolidate and trying to have some sort of concise output from numerous different sources.
P6: It is thinking about thinking, or putting thought into how you are thinking about your teaching into strategies that you're using during the classes.
P7: Thinking about thinking or kind of knowing how you know…Trying to get students to know what they know, but then also know what they need to... to develop in their own practice.
P8: Metacognition is the process or the characterization of reflecting on how you think and by extension, then how you learn... thinking of how you think and come to conclusions and the processes that lead you or students to the outcome that that they come to.
P9: Metacognition is like how the students learn or approaches that I use to help the students learn… I'm not sure what it means.
P10: Awareness of your learning…it's your awareness of what you're doing and your learning, and how you learn and whether you know how figuring it out how you can assess if you have learned it.
P11: I think it is how the students make sense of knowledge and turn it into real life practice.
P12: So, Meta is obviously kind of the 30,000 foot view or the overarching thing. So, cognition it's kind of thinking about thinking and cognition. Think about thinking...being aware of the thinking processes in your mind ...before you might do something during it. And then, after as a reflective piece.
P13: I feel like it's thinking about your thinking...but it's almost like an out of body experience, but where you might pause while you're doing something to consider why you're doing it, or what your rationale might be for doing it, if you're doing it well? Or is there something that you could be doing different while you're actually completing an action.
P14: I actually don't really know. But somebody, recently it described it as thinking about thinking.

5.4.2.1.2 Acknowledgment of the important role of metacognition in allied healthcare education.

Participants demonstrated that pedagogical factors, facilitation of learning, and the bespoke dynamics of healthcare education influenced the inclusion of metacognition in allied healthcare education and impacted their understanding and awareness of metacognition. Participants discussed the practical role of metacognition in allied healthcare education, describing the use of metacognitive awareness in clinical contexts, the complexity of clinical reasoning and the use of metacognition as a framework for guiding and structuring thinking where patient care is very individualised. Many of the participants discussed the large role educators play in metacognitive development of their students within their classrooms, and some outlined the lack of appreciation for metacognition in higher education. In addition, some participants voiced that metacognitive exposure and development should start in post-primary education, prior to arrival in higher education. Participants highlighted that by having metacognitive awareness and understanding, it allows for a pedagogical framework to be applicable universally to all disciplines, facilitating lifelong learning, adding to students' skillsets as future clinicians. Many participants alluded to the role of metacognition in developing future allied healthcare clinicians and the impact this framework may have on healthcare educational programs through the substantial role educators play in developing and cultivating metacognition. Participants highlighted that metacognitive awareness and understanding could be of benefit to the professional attributes of allied healthcare clinicians such as; clinical reasoning, real-world applied practice, critical thinking and theory to practice. These findings substantiate the critical role of educator's awareness and understanding of metacognition that subsequently impacts teaching practice.

Table 5.7 Themes, subthemes and related quotes pertaining to allied healthcare educators understanding and knowledge of metacognitive teaching practices.

Themes	Subthemes	Quotes
Diverse Current Awareness of Metacognition	Personal Interpretation and familiarity of metacognition	P4: "Yeah, it seems to be very important. Obviously, you know, before this, I didn't even know what it meant myself."
		P7: "I think it's one of those things that we don't consciously think about all the time, but possibly subconsciously think about quite often."
		P6:"I think it happens maybe subconsciously, without them (students) realizing it as they develop those skills."
		P5: "I think it naturally occurs for a clinician ...working in clinical practice…the more you are in the environment or in these kind of scenarios that you maybe develop that ability to reflect."
		P10: "Just a recognition and understanding of the importance of being aware of what you're doing, how well you're doing it…just that self-awareness, self-reflection, thinking, self-evaluation."
		P11: "But it's very hard to have higher level thinking when you don't have the basic knowledge."
		P8: "Previous to this discussion, I probably didn't know what metacognition per se was, but had a understanding of some of it, which probably means I don't fully understand it if I wasn't aware of it."
	Contextual and experiential factors	P11: "I think that it's a really difficult concept to and to teach."
		P10: "I'm coming from a place of inexperience with this."
		P13: "Ignorance to a certain degree, I think, is one thing, that we might not value metacognition as much as we should."
		P2 "I was convinced that passing information, this passive type of learning was efficient and effective…I reflected on my own teaching, feedback from students...what seemed hard for them, I reflected on how I approach these specific topics. I ended up realizing...we call it metacognition. "
		P5: "If I wasn't having this conversation with you, probably wouldn't be something that's on my radar"
		P13: "I am in higher education... and I have no teaching qualifications. So, I feel like a novice…I'm imparting my knowledge to students. From a metacognition perspective…I've really no major appreciation or understanding of how I can improve on it."
		P14: "I'm coming in with a lot of experience and a lot of knowledge. But I'm having to learn how to teach as I go."

		P8: "I think that's the most important thing for us as educator is to develop our students as thinkers... I think it's impossible to do that unless we fully understand what that means. And how to apply that process to ourselves firstly, and then teach our students what it is and how to do it after."
		P4: "We've just loads in the content. And the students just sit passively... And there's no discussion, or understanding what their level of knowledge? Is this too much? Are we going to slow or fast? You're just going in and delivering it."
The role of Metacognition in allied healthcare education	Pedagogical factors	P8: "The role remains the same in a lot of ways, regardless of the discipline... But the goal of learning is to be reflective and critical of your own thinking and processes"
		P2 "I think the use of metacognition will allow us to produce completely different kind of clinician than what we have so far... I see how after graduating, they realize there's so much for them to learn and they didn't realize that before...I think it should be built into the undergraduate education, this appreciation for reflective learning and for metacognition."
		P6: "There's no cookie cutter, there's no one says fits all...every injury is quite unique...it's so individualised that you can't just have a like a cookie cutter kind of format for how we treat everybody. So a good therapist has to be able to critical analyse and critically think to become an effective therapist."
		P13: "I think the ultimate goal for AT education is to develop independent clinical practitioners that are lifelong learners... with patient care and health, you have a real due diligence and responsibility to continuously develop and grow with the profession... from a metacognition perspective, it's a skill that we really need to embed within the students by the time they graduate."
		P14: "I believe that metacognition is very important in any medical and health care disciplines, particularly because every patient is different...there is no clear protocols, no clear rehab programs that you can memorize and just copy and paste to your new patient. You have to have a very clear understanding and an ability to look at your patient broadly, at all the other the different aspects."
	Facilitation of learning	P8: "Facilitate them to think about how they are learning...requires them to be critical of their own thinking and processes and then, secondly, to aid them in development of those processes."
		P2: "I think it adds to their skillset, not only in that specific area, but it adds to their skills as learners in general, because they will be able to apply it in any area of their life, and not only athletic therapy... because it's huge as well to be able to learn from our experiences and mistakes."
		P12: "In a good way, I don't care if they get something wrong, or if they don't know something, that my job is to facilitate them learning."
	Bespoke Dynamics	P3: "Well, because it's athletic therapy, and because we know that clinical reasoning is just so important because…we're training thinkers."

		P1: “ So, they have to have those skills to translate theory into practical knowledge and apply that in assessing, treating and planning and management programs for their patients.”
		P11: "I would automatically think that athletic therapists or clinicians probably do have significant metacognition skills, and particularly with the ability to reflect and to really think about cases and to problem solve and get creative about it."

5.4.2.2 Examining allied healthcare educator's current and preferred inclusion of metacognition into their teaching practice.

Three major themes were identified on educator's inclusion of metacognition in their teaching practice (current and/or preferred); key contributors, types of metacognitive strategies, contextual and pedagogical considerations for the implementation of metacognitive strategies, as shown in Figure 5.2.

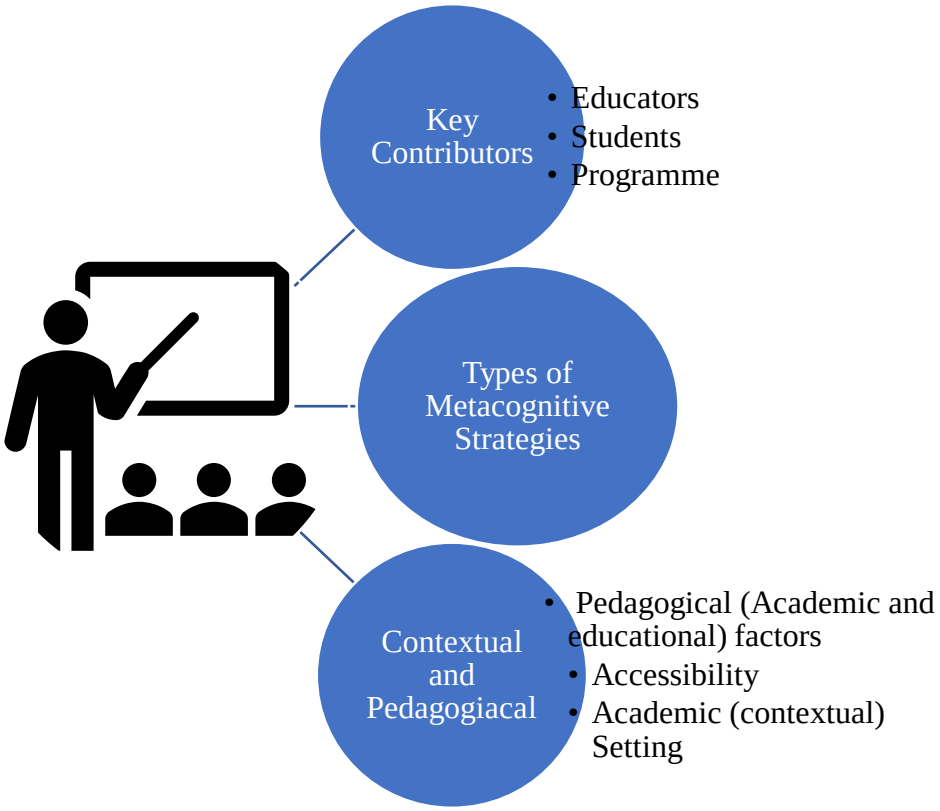

Figure 5.2: Themes examining allied healthcare educator's current and preferred inclusion of metacognition into their teaching practice.

5.4.2.2.1 Key Contributors

Three key contributors were identified as being important in the inclusion of metacognitive strategies into teaching practice including; educators (inclusive of themselves and fellow educators), students and the programme. Participants described that the inclusion and implementation of metacognitive strategies was influenced by a number of factors, including educator's preference, confidence, and personal experience and peer learning in using these techniques. The value of peer learning and sharing of personal experiences with fellow educators' usage of metacognitive strategies were highlighted as being important for educators. In addition, other participants discussed educators having the confidence to implement these strategies into their teaching practice and having the confidence to remain with it.

Encouraging student responsibility and ownership of their learning was important to some participants where they believed that if students were exposed to metacognitive strategies, they would be encouraged to complete more independent learning. However, some expressed concern that implementing metacognitive strategies may only benefit some students and not all. Participants highlighted that the implementation of metacognitive strategies within an allied healthcare programme would need consideration of factors such as the interactive and accessible nature of the strategies, the explicit embedding into curriculums through the continuous use of these strategies and the programme wide adoption which was supported by the majority of participants. Implementing metacognitive strategies across all 4 years of undergraduate study had varying perceptions from participants, some perceived the strategies better used in later years of study, however, others believed that students should be exposed to these strategies from their first day in higher education. Some participants voiced that educators and students desire to use metacognition strategies would require a change from the traditional

didactic teaching and learning approach and the need for students to participate with the learning activities outside of the formal class. In addition, it was highlighted how metacognition could be integrated into postgraduate education also.

5.4.2.2.2 Types of metacognition strategies

Many participants expressed a desire as educators to facilitate learning through the use of metacognitive strategies. Participants shared various different metacognitive learning strategies that they use as part of their practice including active learning strategies', such as case scenarios, questioning/discussions, problem-based learning and flipped classrooms. Others identified using different forms of reflection and feedback as a way to encourage metacognition.

5.4.2.2.3 Contextual and pedagogical considerations for the implementation of metacognitive strategies

In order for educators to include metacognitive strategies into their practice, resources, professional development, support from management and the availability to invest time into developing metacognition as a framework was voiced multiple times by participants. Many participants expressed the desire for more resources and support to be readily available to aid in their implementation. Additionally, professional development was highlighted by most participants, expressing a desire to undertake some form of formal educational training or the ability to attend workshops in this area. The environment, culture and modular design were factors in the academic setting that participants suggested may impact the implementation of metacognitive strategies for allied healthcare educators. The physical environmental space for metacognition to be embedded into practice was highlighted by some, where formal lecture theatres commonly exist and potentially hinder the implementation of metacognitive strategies in a classroom. In addition, cultural perceptions between educators, students and management

were reported, where participants expressed the need to change students' perceptions on learning. There was a belief among some participants that the inclusion of metacognitive strategies was modular-dependent, while others believed metacognition could be integrated into all modules including assessments. Contrastingly, some participants queried the evidence-based practice of metacognition in teaching.

Table 5.8 Themes, subthemes and related quotes pertaining to Allied healthcare educator's current and preferred inclusion of metacognitive teaching practices.

Themes	Subthemes	Quotes
Key Contributors Role	Educators	P2: "If I see they're making progress…that will make me keep going, and that will make me try even harder and find even better strategies…It was dependent on my personal growth as a lecturer."
		P4: "So my own experience is some small elements within the lectures just scattered in, and then a lot more of it in in the labs and the practical classes where it's emphasized a lot more."
		P9: "Some of the best things that I've learned is when I'm sitting down chatting to other lecturers…This is what I've done…That's the gold there"
		P3: "Confidence to just stick with this and not bail out and go to the easy option of Powerpoint slides when it all gets a bit uncomfortable"
		P13: "If they're aware of it, then they can definitely be invested in the long term continuity of it, because programme chairs will change, and as a result the culture will naturally change...be a bit more consistent."
	Students	P1: "Giving students more of the ownership to do a lot of the learning outside of the classroom... there's more interactive sessions going on to discuss learning, to check learning acquisition... passing some of that accountability back to students to do the pre-session reading and the pre session learning."
		P2: "We need teach the students how to effectively, independently learn using metacognition, reflecting on their own learning"
		P5: "Typically the very good students kind of shine in those situations. And maybe the weaker students that are very passive that don't get involved in the process, because those situations, generally it's dialogue between myself and the class"
		P14: "There's a definite lack of students taking responsibility for their own learning and their own reflective practice, and independent ownership of their learning journey.... They probably need to be spoon fed. They need to be told what they need to do to be independent."
		P10: "And maybe their confidence doesn't match their competence."
	Program	P3: "Better to do more discursive things and more interactive things, because just sitting there listening, it's really hard."
		P1: "Accessible, and quick, because typically students maybe don't engage outside the classroom"

		P5: “Embedded in every module, and the students become much more familiar with the approach and I suppose the frequency of their exposure to it would make them much more efficient at that kind of process”
		P6: “I think it should be something that the programme encourages and that is expected of it. But within that I think staff should have the freedom to do how they see fit”
		P7: “I don't think we have a good enough understanding of it for it to be program-wide implementation”
		P6: “So I think it is definitely something that can be applied across all aspects of education, probably even down to secondary school... when they come into first year, they're so used to just being told this is the right answer, and try to memorize the right answer. And then we're trying to change that over 4 years. Well, it's not necessarily one right answer.”
		P9: “It should start from the start...be gradually implemented. Obviously, when you're dealing with first year, it's quite different than when you're dealing with the fourth year, the content delivery and the information gonna give, it's gonna be different. But yeah, like, I think it should slowly be implemented across the years.”
		P8: “Because I'm assuming a lot of these strategies would also be useful like at a Ph.D. Level”
		P11: "A programme specific agreement on what we want to do regarding metacognition. That agreement is among staff, and that almost like a little matrix, we decide how it's delivered across them all."
Types of metacognitive strategies		P3: “So I like to get students to write about reflection. I'm a bit of a believer in writing as a way of distilling your thoughts and your thinking, and creating an argument, and then reflecting on whether you think it's useful".
		P6: "I would often use kind use a small quiz... and get the students answers to pop up themselves so they can be aware of where their gaps in learning are."
		P1: " So we'll discuss a particular case scenario, and then I'll have questions based on that scenario and link back to the lecture content."
		P5: “You might reassess or evaluate. How did I do with that during that interaction? Or how did I decipher that information? How did I come up with my kind of diagnosis”
		P12: "I give them like 2 prompts generally, So what did I do? What can I improve on for my next ankle assessment?"
		P13: "We have implemented artificial intelligence in our clinics...AI will provide them with feedback on their questioning. Was it too open ended? Was it too closed? How was their tone of voice? Did they rush the patient? Did they consider everything? Then AI will prompt with questions. Why did you think you jumped to that diagnosis so quickly, did you didn't consider this? Why is that?"

		P12: "Asking leading questions that may but just to play a devil's advocate, and so that they're again rationalizing, and they're thinking about it."
		P8: “Flipped classrooms and active learning from day one because I just find it gets the students more engaged straight away”
Contextual and Pedagogical Considerations	Pedagogical (Academic and educational) factors	P5: "Is this proven to be useful? Has there been evidence, appropriate evidence established on these teaching strategies that has shown that they are effective at improving a student's metacognition?”
		P1: “Because we have to translate theory into practice. So students kind of know all of the theory, all of those building blocks in place, but they have to be able to demonstrate that because their job will be a very hands-on applied practice.”
		P6: "I think if they don't have an understanding of what it is they're not thinking about how the students are thinking, I suppose, then it's very hard to change what they're doing to make sure it's appropriate for that student or for that group, or that that year group.”
		P14: "To be spotting and appraising and registering and changing where I see things that need to be improved."
	Accessibility	P7: “A repository.”
		P4: “A 2-page document with a lot of examples or suggestions, I think will be brilliant”
		P1: "Having some support with our strategies...“formal teaching of it would be useful.”
		P2: “There isn't enough, I guess, resources and support for lecturers in this kind of sector to grow in AT education and to grow us lecturers using metacognition and practice....So again, if there are no resources, if there is no push at departmental level. If there is no internal push in them to implement this, they will not be implement it”
		P10: "Education for educators...Obviously, you've educated me now in this interview on it. I think it can only develop if we, as educators...we need more awareness, understanding of what it is, how we can use it. I suppose evidence... You know, we're all scientists, I suppose. Evidence to show how it could change things for students."
		P14: "Yeah, I'd need some formal education in it, what it involves and what are the tools I could use, and how I could do it."
	Academic (contextual)	P2: “Type of physical classrooms the students are in would also impact on ability to deliver certain type of strategies.”
		P3: “And especially if you want to put them into groups, and there's not really a natural space in the room for them to sit together.”

		P7: “Some class where you've got like loads of paper and colouring pens, and you know it's a little bit more creative and expressive. We tend not to do that kind of stuff. And so I think something like that would encourage that kind of more creative learning process would be beneficial.”
		P6: “Good open line of communication not only to share the idea of metacognition, but actually sell it to the policy makers.”
		P1: “Whole mindset change... So we do need kind of a cultural change within that as well, which perhaps, then, is not just an individual lecturer, but it's more a department wide change as well.”
		P8: “to try to teach the students to think about the topic more than to rote learn theory…..if I can create an environment where that's the primary focus... If we can facilitate that, then applying that to any level of knowledge, becomes much easier for the students to progress.”
		P10: "I think, as a nation and culture, we're terrible at reflecting, being self-aware, this kind of thing is foreign to us. It probably comes back to that Leaving Cert you just take from the book, and that's it. And I think yeah, it's nearly innate in us."
		P11: "I think in real world scenarios someone with higher order thinking might be considered a disruptor."

5.5 Discussion

The aims of this study were to i) explore allied healthcare educators' awareness and understanding of metacognition and ii) examine educators' inclusion of metacognitive strategies in their teaching practice. We found 67.9% of participants had heard of metacognition, with 54% of educators *always* self-reflect on how they think their class went. In addition, we noted that 50% of educators *often* ask students what they know about a topic before teaching it and 57% *often* use group work to facilitate students' metacognitive thinking. These findings were further substantiated by interviews conducted on allied healthcare educators' awareness and understanding of metacognition, where two main themes were reported; diverse awareness by educators and the role of metacognition. In addition, three themes were constructed from the inclusion of metacognitive strategies; i) key contributors' ii) types of metacognitive strategies, iii) contextual and pedagogical considerations.

The findings of this study highlighted allied healthcare educators' diverse awareness and understanding of metacognition, evident in participants' definitions of what they understood metacognition to be. Some participants correctly identified the reflective components of metacognition, with only a few noting the specific regulatory components of metacognition, to plan, monitor and evaluate one's thinking (Schraw, 1998). Despite two thirds of participants having an awareness of metacognition, it could be argued that participants expressed a superficial knowledge of what metacognition is, stating it was "thinking about thinking". Furthermore, 32.1% of allied healthcare educators in this current study had never heard of metacognition. Similarly, in science educators, 90% did not know about metacognition resulting in a theory to practice gap occurring, compromising the benefits of metacognitive practice for students through unchanged policies and curriculums (Ben-David & Orion, 2013; Georghiades, 2004). Educators' fragile and fragmented understanding of metacognition can be

a significant barrier to the development of metacognition, as educators are unable to effectively teach metacognition to students, without firstly having a good general understanding of it themselves and then having specific pedagogical knowledge relating to how to teach it (Wass et al., 2023; Zohar & Barzilai, 2013; Zohar & Ben-Ari, 2022; Zohar & Lustov, 2018). Therefore, educating the educator of the significant role metacognition plays in students' learning and academic performance, is of critical importance.

Educators personal and past experiences play an important role in their understanding and awareness of metacognition (Karlen et al., 2023; Zohar, 2006), where some educators in this study stated they mimic what they knew and had experience of. In this study, years of teaching experience and having a formal teaching qualification did not significantly impact educators' awareness and implementation of metacognition. However, the lack of formal educational training for allied healthcare educators working in higher education in Ireland was voiced by a number of participants in this study. In the literature, formal teaching training was associated with increased metacognitive awareness, resulting in enhanced likelihood of promoting metacognition in their classroom (Consadine & Goodman, 2025; Zohar & Lustov, 2018). Hence, all educators have the capabilities to develop their knowledge and understanding of metacognitive strategies and implement them into their classroom setting, regardless of years of teaching experience or formal teaching training.

Despite the diversity in allied healthcare educators reported awareness and understanding of metacognition, there was an overall assumption of the importance of metacognition in higher education, inclusive of participants who had no knowledge or very limited knowledge of metacognition and in particular the importance of it in allied healthcare programs. Many participants highlighted the value of metacognition for guiding thinking and enhancing clinical reasoning skills as patient care is very individualised. Experienced clinicians

rely on their metacognitive abilities to effectively and efficiently use clinical reasoning skills (Kosior et al., 2019), evident in the rapidly changing nature of medicine (Cale & McNulty, 2024). Additionally, participants viewed metacognition as a framework that could be applied to many different contexts (Wass et al., 2023), facilitating lifelong learning in the allied healthcare professional domains (Cutrer et al., 2021). Participants further highlighted this by the emphasis placed on developing future clinicians and the responsibility that educators have in cultivating this. Metacognition is viewed as an educational tool with broad applications (Dunlosky & Rawson, 2019), however, its application in allied healthcare still remains largely unknown (Biwer et al., 2023; Schmidt & Mamede, 2020). Despite this, the importance of metacognition and clinical reasoning remains fundamentally important for allied healthcare professionals and students providing them with a cognitive infrastructure to guide their thinking and clinical reasoning.

Half of allied healthcare educators in our study *often* ask students questions about their prior knowledge of a topic before teaching it, as supported by Tanner (2012), in the development of students' metacognition. In addition, 39% of participants *sometimes* use metacognitive teaching strategies', such as concept maps, student think-aloud, self-assessment using marking criteria, peer assessment and asking students questions to articulate what they do and do not understand, and what they would do differently next time. In contrast to this, 50% of participants *never* use ConceptTests (a challenging question is posed to students, they vote on the answer, discuss it and vote again) and 32% *never* ask students to rate their confidence in their answer. Overall, the implementation and frequency of use of metacognitive teaching strategies could be increased by allied healthcare educators in this study. These findings are similar to Dennis & Somerville (2022) who found no explicit inclusion of metacognition in higher education teaching, as a result of a lack of awareness of metacognition

among academics in higher education. However, some implicit uses of metacognitive strategies are often used in a very limited way such as identifying prior knowledge, rather than the development of regulatory components of metacognition. The reason behind the infrequent use and explicit embedding of metacognitive teaching strategies could be due a number of factors, such as a lack of awareness and knowledge, exposure, time and modular constraints, and educators personal experience and confidence to implement them (Ben-David & Orion, 2013; Gamby & Bauer, 2022; Karlen et al., 2023). For successful implementation of metacognition, some of the educators voiced that metacognition should be embedded programme wide and very early on in undergraduate programmes. This would aid students to become more metacognitively aware by being more familiar with it and seen as *the norm* for higher education teaching practice (Cale & McNulty, 2024; Consadine & Goodman, 2025; Karlen et al., 2023; Stephens & Santangelo, 2022). Peer-learning and support for educators was highlighted by some participants as being very important in encouraging educators to embed these strategies into their teaching practice, as supported by McCorkle (2021). However, many participants stated that their lack of understanding of metacognition may hinder them from implementing metacognitive strategies. This was evident in educators who were more familiar with metacognition, who demonstrated significantly better intentional implementation of metacognitive teaching strategies than educators who are only marginally familiar or entirely unfamiliar with metacognition (Consadine & Goodman, 2025). This re-enforces the need for higher education educators to undertake formal pedagogical training, providing the opportunity to develop metacognitive teaching strategies as a result.

Contextual and pedagogical considerations, such as evidence-based practice, resources, professional development, support from management and time allocations, are needed to embed these metacognitive strategies into practice, as highlighted by participants in this study.

Educators need to have resources and support if educational reform is to take place (Zohar & Ben-Ari, 2022). The physical teaching environment was also highlighted by some participants as not being conductive for the implementation of these metacognitive teaching strategies, whereby traditional formal lecture theatres spaces still exist quite extensively in Ireland. Furthermore, cultural perceptions of teaching and learning in higher education needs to change (Ben-David & Orion, 2013; VanWyngaarden et al., 2024), shifting the role of the educator from lecturer to facilitator (McCorkle, 2021). For the implementation of metacognition to be embedded into allied healthcare professional educational training, policy makers and faculty management need to make changes to the curriculum and teacher education in order for this occur (McCorkle, 2021; VanWyngaarden et al., 2024; Zohar & Barzilai, 2013).

5.5.1 Engaging the student

The transition into higher education requires students to take increasing responsibility for their own learning for academic success (Consadine & Goodman, 2025; Lumpkin, 2015; Ohtani & Hisasaka, 2018). In our current study, for the successful implementation of metacognitive strategies, they need to be accessible, have real-world application, and be interactive for students to engage with, inside and outside the classroom (Avargil et al., 2018; Schraw, 1998). Most educators have a student-centred approach to their teaching, and this is evident in this current study, where 64% of educators report a desire to improve their class session. In addition, half of our educators *always* notice how students are behaving during a class to see if they are engaging with the content and their peers. This can be viewed as educators being personally self-reflective but moreover a desire to engage students in class content in a deeper and more meaningfully way, developing their metacognitive thinking skills (Wilson & Bai, 2010). For effective teaching and learning to occur in higher education, it requires both educators and students to consciously engage with reflection, developing good

metacognitive practices (Stephens & Santangelo, 2022) and ultimately, leading to good patient care, by enhanced clinical reasoning (Koufidis et al., 2020; Norman, 2005; Young et al., 2020).

Through identifying specific knowledge and skills deficits, educators can choose suitable learning techniques and experiences that are appropriate and facilitate metacognitive skills that are specific to the individual student's knowledge (Versteeg et al., 2021; Wilson & Bai, 2010). Practical ways to enhance metacognitive awareness and practice in classrooms as stated by Schraw (1998) included; allocating time to group discussion and reflection, regardless of curriculum constraints. This was evident in our study, where 57% of allied healthcare educators stated that they *often* use group work to allow students to explain their thinking and rationale to each other. Much of the literature advocates that students and educators describe and model their thinking processes through activities such as think-aloud or concept mapping (Medina et al., 2017; Tanner, 2012; Zohar & Barzilai, 2013). This was demonstrated by 39% of our respondents stating they *sometimes* use concept mapping, think aloud or ask students to articulate what they do and do not understand about a topic. These strategies were further discussed by educators in their interviews, stating they play devil's advocate, utilise case scenarios and flipped classrooms to get students engaged more effectively. Metacognitive strategies are not simply demonstrating "how" to perform a task, but asking oneself "how and why", modelling self-reflective and self-regulatory components of both metacognition (Schraw 1998), and clinical reasoning. Students and educators can use a regulatory checklist of simple questions post a clinical encounter to include; "What is the nature of the task? Am I reaching my goals? What worked well? What did not work?" (Schraw 1998, p. 121), to enhance metacognition. Regular and deliberate practice of metacognitive skills is needed (Dunlosky & Rawson, 2019; Ellis et al., 2014) as when these skills are "exercised, strengthened and consolidated" they foster metacognition (Kuhn, 1999 p.24). Therefore, student engagement and

buy-in is of critical importance and as a result, all key contributors, educators, students, and faculty members all need to have a good understanding of the purpose and benefits of metacognition in higher education to support this engagement (Zohar, 2006).

5.5.2 Limitations

There are some limitations to this study. Firstly, the use of self-reported questionnaires has limitations such as social conformity and desirability bias (Craig et al., 2020; Harrison & Vallin, 2018). This may have led to issues with honesty and accuracy of responses. Despite this, the use of semi-structured interviews provided a rich and in-depth perspective from educators that may not have been possible by questionnaire alone. Convenience sampling was used in this study and low study numbers were recorded, however, a large response rate of 55% of participants completed the questionnaire. Participants in this study were all employed in Irish universities teaching on one of three ARTI accredited athletic therapy programs, thus limiting the generalisability of the results internationally.

5.5.3 Future research

Future research should explore ways in which professional development in metacognition can be facilitated for educators and faculty members and to establish its effectiveness. In addition, future research should seek to investigate resources that educators can implement that are accessible, adaptable and comprehensive for the development of metacognition in a variety of contexts. Future research could explore the cultural and environmental aspects involved in embedding metacognition into an allied healthcare program, determining the barriers and facilitators to this. Finally, examining the establishment of best practices in implementation and development of metacognition in higher education, especially in allied healthcare programmes, is recommended.

5.6 Conclusion

Metacognition plays a critical role in the enhancement of student learning and in particular the development of effective and efficient clinical reasoning in allied healthcare educational programmes. The findings of this study highlight that despite its familiarity by a large proportion of allied healthcare educators, there is need a for more robust understandings of metacognition. Educating the educators and supporting them in the delivery of this, and the central role metacognition plays in students learning and academic performance, is of critical importance. This enhanced knowledge of metacognition may translate into greater implementation of metacognitive strategies in higher education. This can be enhanced by specific support and resources to aid educators in the implementation of metacognitive strategies into their teaching practice, further supporting students in their lifelong learning as future clinicians. This is underpinned by professional development in pedagogical training to enhance learning and ultimately metacognition.

Summary of Chapters 5 and its link with chapter 6.

Chapter 5 examined athletic therapy and allied healthcare educators' awareness, understanding, and implementation of metacognitive teaching strategies. Chapter 5 highlighted educators' varying levels of understanding and awareness of metacognition, yet despite this, educators consistently placed an importance on developing students' metacognitive awareness. This was evident in some participants' implementation of metacognitive strategies and their desire to further implement these strategies into their practice. Exploring the barriers and facilitators of implementing metacognitive strategies into athletic therapy education will educate and empower educators and students to cultivate and foster a metacognitive teaching and learning environment, enhancing student learning and performance. In order for these findings to have meaningful and practical significance, the barriers and facilitators to educators' successful implementation of metacognition into practice are explored in Chapter 6.

Chapter 6 Barriers and facilitators to implementing metacognitive teaching strategies in allied healthcare education: A qualitative study.

Chapter 6 Barriers and facilitators to implementing metacognitive teaching strategies in athletic therapy and allied healthcare education: A qualitative study.

6.1 Abstract:

Metacognition is a multidimensional higher order cognitive process that is correlated with academic development and lifelong learning. Enhancing students' metacognition is of vital importance for the development, refinement and advancement of clinical reasoning skills and practice in healthcare professionals and education. Despite the importance of metacognition noted in the literature, its implementation into athletic therapy and allied healthcare teaching practice remains largely unknown. Therefore, the aim of this study was to explore the barriers and facilitators to implementing metacognitive teaching strategies in athletic therapy and allied healthcare education. Semi-structured interviews (n=14) were conducted on educators' teaching on athletic therapy programmes in higher education institutions in Ireland. In this study, reflective thematic analysis revealed four barriers to educators' implementation of metacognitive teaching strategies; 1) lack of knowledge and awareness of metacognition, 2) time, 3) student engagement, and 4) educational constraints. Three themes were identified as facilitators for implementing metacognitive teaching strategies: 1) faculty development 2) student learning and ownership, and 3) promotion of metacognition. These findings suggest that despite the many barriers to implementing metacognitive teaching strategies, they may be overcome through educational training and upskilling in this area to enhance student learning.

6.2 Introduction

Metacognition is a higher order cognitive process that requires the conscious awareness and control of one's thinking (Flavell 1979). This process requires regulation, reflection and

evaluation of knowledge to identify gaps and take remedial action as needed (Medina et al., 2017; Tuononen et al., 2022; Wilson & Bai, 2010). Metacognition is fundamental to how students learn and is the second most powerful predictor of learning (Wang et al., 1993). Therefore, it enhances academic performance (Abdelrahman, 2020; Perry et al., 2019; Stanton et al., 2021) across students of differing abilities (Wass et al., 2023), and it is essential for adaptive and lifelong learning (Avargil et al., 2018; Cutrer et al., 2021; Pintrich, 2002; Zohar & Barzilai, 2013). The implementation of metacognitive strategies into undergraduate psychology education improved classroom communication and facilitated effective academic performance, (Azevedo, 2020; Hartman, 2001), a primary objective for both educators and students. Therefore, metacognition plays an essential role in the education of allied healthcare professionals, improving student's mastery of cognitive skills, and helping them understand the "why" of learning, especially during failure, to avoid repeating the same mistakes again (Hartman, 2001).

Despite the importance of metacognition in the literature for the past 40 years, its implementation into athletic therapy and allied healthcare teaching practice remains largely unknown (Biwer et al., 2023). The adoption of any new teaching strategy is determined by barriers and facilitators for the application into teaching practice (VanWyngaarden et al., 2024). Factors such as pedagogical understanding of metacognition, formal training and educators' beliefs and perceptions were commonly stated as barriers and facilitators to the implementation of the metacognitive teaching strategies into educational practice (Zohar & Ben-Ari, 2022). As would be expected, educators with limited knowledge of metacognition were unfamiliar with appropriate learning tasks and strategies designed to support the implementation of metacognition (Zohar, 2006). Furthermore, educators may be unwilling to change, be sceptical or unmotivated to adapt their teaching practice to embed metacognitive strategies into their

content and classroom by barriers of time, resources and curriculum constraints (McCorkle, 2021; Van Wyngaarden et al., 2024; Wass et al., 2023). Other factors such as educators' self-efficacy and confidence to implement metacognitive teaching strategies in the absence of a supportive community of practice, can also be a barrier (Ben-David & Orion, 2013; Van Wyngaarden et al., 2024). In addition, changing educators' perceived opinions and beliefs about teaching can be challenging and can be viewed as a barrier (Ben-David & Orion, 2013), especially if educators teach in the ways they were taught as students, without considering alternative approaches (Hartman, 2001). Hence, professional educational training in metacognition is needed in an attempt to overcome these barriers.

A primary goal for many educators in higher education is to enhance their teaching practice to enable a learning environment that is conducive for efficient learning to take place. Therefore, some of the facilitators for the successful implementation of metacognition into education include; 1) embedding metacognitive strategies into curricular content, 2) informing both educators and students of the benefits and usefulness of metacognition for learning, and 3) ongoing training to support the application of metacognition into educational practice (Azevedo, 2020; Wass et al., 2023; Zohar & Barzilai, 2013). In addition, having an engaging curriculum that actively involves students to collaboratively participate in learning tasks (Ellis et al., 2014), and provide opportunities for students to articulate their thinking (Zohar, 2006), may enhance the embedment of metacognition.

Educators' implementation of metacognitive teaching strategies can increase students' motivation to learn and facilitate enhanced metacognitive awareness, thus leading to improved academic performance (Abdelrahman, 2020; Sasson & Tifferet, 2025; Wagener, 2016). However, educators in higher education are rarely taught about metacognition or trained to embed metacognitive strategies into their teaching practice (Pintrich, 2002; Wass et al., 2023).

Therefore, its role in higher education is less well known and in particular, in allied healthcare education (Ben-David & Orion, 2013; Cale & McNulty, 2024). In order for educators to successfully implement metacognition into their teaching practice, they first must understand it and know how to teach it by using appropriate metacognitive teaching strategies (Ozturk, 2017; Zohar & Ben-Ari, 2022). In addition to this, a theory to practice gap may exist, whereby despite the known theoretical benefits of metacognition, few studies have examined educators' implementation of metacognitive teaching strategies in higher education (Dennis & Somerville, 2022). To our knowledge, no research has examined athletic therapy and allied health educators' perceptions of the implementation of metacognition in higher education. Therefore, the aims of this study were to identify the barriers and facilitators to implementing metacognitive teaching strategies in athletic therapy and allied healthcare education.

6.3 Methods

6.3.1 Research design

This qualitative study adopted a phenomenological approach (Rodriguez & Smith, 2018) to facilitate an in-depth understanding of the perceived barriers and facilitators to the implementation of metacognitive teaching strategies in Irish Athletic therapy education (Rodriguez & Smith, 2018). By focusing on the individual experience of each participant, the qualitative approach allowed us to generate new and meaningful information to the topic under investigation.

6.3.2 Participants

Fourteen semi-structured interviews were conducted between December 2023 to February 2024 with male (n=6) and female (n=8) allied healthcare educators. A purposive

sample of higher education educators teaching on an ARTI-accredited athletic therapy programs in Ireland were recruited. Participants professional background training included; certified athletic therapists (n=5), chartered physiotherapists (n=4), dual qualified as certified athletic therapist and physiotherapist (n=1), sport scientists (n=2), strength and conditioning coach (n=1) and a sport psychologist (n=1). Participants were recruited by word of mouth, social media and direct contact with the programme chairs of the ARTI-accredited institutions. Ethical approval was granted by the DCU Research Ethics Committee (DCUREC/2023/117) and participants provided informed consent.

6.3.3 Procedures

The semi-structured interview guide (Appendix 10) with open-ended questions and prompts was developed. The interview guide was informed by relevant literature in the area (Dennis & Somerville, 2022; Zohar, 2006) and the authors' knowledge and experience as educators in higher education institutions in Ireland. The interview guide was piloted with 2 additional allied healthcare educators and took 45.0±9.1 minutes to complete. Pilot interviews also aimed to educate and train the primary author (LA) in efficient interview techniques. No changes to the interview guide were deemed necessary after piloting. Results of the pilot study are not included in the analysis. The semi-structured interviews were conducted online on Zoom (Zoom Video Communications, Inc., San Jose, CA) by the researcher. Interviews lasted 48.5±12.9 minutes and were video and audio-recorded for subsequent transcription and analysis. The two main areas investigated during the semi-structured interviews were: what are the a) barriers b) and facilitators to implementing metacognitive teaching strategies in allied healthcare education.

6.3.4 Data analysis and trustworthiness

The transcripts were analysed using the six-phased approach for reflective thematic analysis (Braun & Clarke, 2006, 2019). Data was auto-transcribed in Zoom and reviewed for accuracy to allow the researcher's deep immersion into the data and to ensure familiarity prior to data coding. After familiarisation, initial coding was conducted, which allowed the generation of initial themes. Themes were then reviewed and refined, allowing for hierarchical themes to be developed (Byrne, 2022). A 'critical friend' approach was adopted during analysis with one of the research team to facilitate discussions on additional perspectives and interpretations of the data. After discussion and refinement, the preliminary thematic structure was discussed and agreed by the research team, before the final report was prepared. NVivo14 (QSR International, Melbourne, Australia) was used to analyse the data. Reporting adheres to the Standards for Reporting Qualitative Research (SRQR; O'Brien et al., 2014) checklist (Appendix 11).

The researcher was experienced in the athletic therapy education environment, which brought familiarity and awareness to topics discussed by participants in each of the interviews. This helped build trust and rapport with participants which supported the breadth and depth of the data collected. Furthermore, in the presentation of the results, multiple examples are provided from the transcripts to highlight the diverse viewpoints and contributions from all participants. An audit trail was kept throughout the research process that contains a complete set of notes and decisions made to ensure dependability and confirmability (Korstjens & Moser, 2018).

6.4 Results

The interviews (n=14) identified 4 major themes as barriers for the implementation of metacognition; lack of knowledge and awareness of metacognition, time, student engagement and educational constraints as shown in Figure 6.1. Participants reported 3 main themes as facilitators; faculty development, student learning ownership, time and promotion of metacognition for the development and utilisation of metacognitive teaching strategies in their practice, as shown in Figure 6.2.

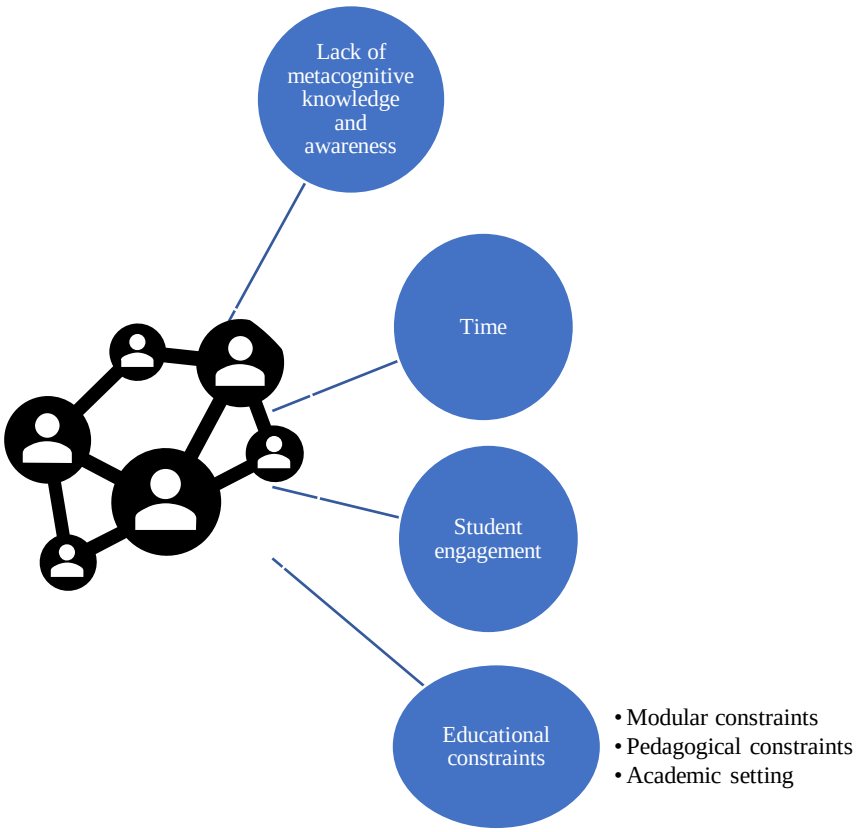

Figure 6.1: Barriers to implementing metacognitive teaching strategies in allied healthcare education.

Table 6.1 Barriers to the Implementation of Metacognitive Teaching Strategies into Allied Healthcare Education

Themes	Subthemes	Quotes
Lack of knowledge and awareness of metacognition		P9: "People are afraid like when you're in the job and are afraid to go - I don't know what that is or I don't understand. People do not want say that."
		P12: "Limitations of the educator in their knowledge of metacognition and the methods in which they can deliver those."
		P14: "If you don't know that the topic is there... and could be of benefit to people, then that lack of knowledge is the barrier, isn't it?"
		P13: "I'd say ultimately, ignorance to a certain degree... we might not value metacognition as much as we should, and as a result we don't embed it in as much as we should…I think it's just like lack of exposure, lack of knowledge on how we can do it."
Time		P2: " It might be just easier to talk for 2 hours rather than take the time to teach students how to reflect, and how to think about decision making."
		P1: "Time to prepare the strategy initially and then time during the weekly session to set aside time to use that strategy, knowing how much content has to be covered and have students engage with it."
		P2: "Very often educators just lack time. They know what they would like to do, but they don't have time to do it."
		P8: “Time to upskill in the strategies to learn more about them, and both from a theoretical and implementation perspective.”
		P9: “It takes time to develop them. Because you're really thinking, what am I targeting in the students? What are they actually learning from this? And for me it always goes back to can they actually use this? Does this actually benefit them?”
Student engagement		P5: “If they're not confident, or they don't have the ability to ask a question, they’ll shrug their shoulders and go “I don't know.” And then maybe they end up just listening to someone else within the class, and maybe don't get as much value as the student that actually has that process of trying to come up with an answer and actually verbalizing it.”

		P13: "Previous experience of the students…they think that they can just show up, do the exam and pass. That's their impression, because that's what they got for their Leaving Cert... they're not able to engage with their peers...to give them feedback...peer feedback at this time is quite difficult for them, because their reputation in a societal perspective is so valuable to them, and they're probably not being very open with each other because they don't know how to be."
		P10: "I suppose if we were to teach the students about it. It's getting them to engage with it, getting them on board."
		P12: "I think there might be some students that might be particularly, let's say, resistant to engaging...there might be personality differences, or else might be learning difficulties for a given student, and that would need to be considered."
		P14: "Because often there's a definite lack of students taking responsibility for their own learning and their own reflective practice...I just think, in 1st year you just don't see it at all, and then I think it depends on the individuals."
Educational Constraints	Modular Constraints	P2: "Curriculum barrier exists. There is so much to learn and teach students, and we have such a limited amount of time."
		P5: "It will be next to impossible to have any real, meaningful kind of dialogue with an individual, or even like a small group of students and still try to keep everything running kind of efficiently."
		P6: "Too much content actually ...finding time within it to take a little step back and assess the students learning, or their thought process on, that can be quite difficult. There's so much formal assessments to get done with the class that can be quite difficult to find the time within it to really focus on it."
		P4: "Preparation time... allow enough preparation time to think of all the examples maybe integrated into your slides as a prompt for yourself while you're in in the lecture or lab."
		P8: "Do we need to be less worried about didactically covering all the content?"
		P8: "Requires work in terms of embedding some of the principles across the programme books and across all of our modules maybe more clearly".
		P11: "That's a really difficult concept to teach."
		P4: "Might revert back to your old habits".

	Pedagogical Constraints	P8: “I think that's the biggest challenge at third level is that we're domain experts. We're not experts in education per se... if you even think about how we progress as academics and lecturers, it's very much based on our contribution to our domain expertise and our research, not in on our ability to teach the students in front of us...in terms of how you're rewarded, it's not based on upskilling in teaching and educating. It's based on bringing more money into universities, through research funding and publishing more papers, and so on."
		P13: "There's just so many roles and responsibilities that I have within higher education that I actually don't have the capacity or the time to give to improving myself as a teacher...They're (Universities) more metric driven, you know, like funding research output, publications, supervision of Prof. Docs, PhDs, Masters...But nobody's asking about your teaching."
		P13: "I'm in higher education. I'm actually not a qualified teacher or a qualified educator... But nobody's ever taught me how to teach. But primary school kids they have people that are qualified in teaching them. Secondary school kids have the same. And then here I am in higher education, which is arguably quite an important influence on someone's career, and I have no teaching qualifications."
	Academic Setting	P1: "So do we need a cultural change …its not just an individual lecturer, but it's more a department wide change as well?"
		P3: “So, sometimes it might be hard to get people to buy in for every module, you know, to do an active learning activity."
		P7: "All our lecture theatres are classic tier face forward, chairs don't swivel side to side... so they're very set up for that chalk and talk type approach…from an infrastructure point of view."
		P3: "The lecturers at the bottom talking, and everyone is like listening, and has a good view, but there's no space for collaboration within a lecture theatre. It's all just passively sitting and watching and listening.”
		P2: “Students coming into third level education are really focused on memorizing and getting the marks that they need to pass and not understanding the value of independent thinking and independent learning."
		P7: “Students aren't used to talking in front of a group…I think that's part of the learning process. But it's definitely a barrier early on."
		P6: "I think there can be an element of people not necessarily looking for change.”
		P9; “If this is how I've done it, you know, I'm not going to learn anything. This is how it is, you know…people often aren’t bothered, you know.”

6.4.1 Barriers

6.4.1.1 Lack of knowledge and awareness of metacognition

The majority of participants voiced that a primary barrier to implementing metacognitive teaching strategies in allied healthcare education was educators' lack of metacognitive knowledge and awareness. Coupled with this lack of knowledge, a lack of exposure to metacognition was also highlighted a barrier. Due to a lack of knowledge and awareness of metacognition, participants expressed a reluctance of educators to even try to implement these strategies, or to seek out further information about them. Despite the lack of knowledge expressed by many, there was a desire to gain a better understanding of how it could be applied within modules.

6.4.1.2 Time

Participants highlighted various time constraints as barriers to the implementation of metacognitive teaching strategies. One such constraint was preparation time needed in developing these strategies. Many participants also expressed concern with regard to the time constraints that already exist to fulfil the programme and curricular requirements alongside overloaded curriculums. In addition, participants noted it was less time consuming to teach didactically instead of implementing metacognitive strategies into the classroom, which required a time investment. Furthermore, some participants voiced a desire to upskill, however, acknowledged that time may be a barrier preventing this from occurring.

6.4.1.3 Student engagement

Participants highlighted that the lack of student engagement can make the "buy in" into new teaching and learning strategies more difficult. Participants stated that students may be resistant to metacognitive teaching strategies if they have a learning disability. In addition, participants highlighted students' unwillingness to assume responsibility for their learning may

also be a barrier to successfully implementing metacognitive strategies in the classroom. It was felt that they may lack the capacity to self-reflect and to learn independently, as it may never have been taught explicitly to them. In addition, participants voiced concern over the educational system in place prior to entry into universities, where rote learning and memorisation was felt to be commonplace, alongside a reluctance in participating in activities such as articulating their thinking in front of the class and providing peer feedback.

6.4.1.4 Educational Constraints

6.4.1.4.1 Modular constraints

Many of the participants highlighted that a curriculum barrier exists, whereby educators are expected to cover all modular content with students, making the implementation of metacognitive strategies challenging. One participant queried if educators need to cover all content didactically and also stated that the implementation of metacognitive strategies requires work to be embedded into all modules and programme books. Some participants articulated that metacognition is a difficult concept to teach and finding the time to metacognitive assess students was also another barrier due to the curricula requirements of formal assessment that must be completed.

6.4.1.4.2 Pedagogical constraints

Participants voiced that educator's teaching style and preference could be a barrier, with some stating returning to more traditional and didactic teaching as a long-term barrier. Others highlighted that as educators they are domain experts but not in education. A lack of formal training in education was identified by many as a barrier, further emphasised by how progressions in universities may often be based on research and funding with less of a focus

on teaching achievements and excellence. This is further compounded by modular and time constraints.

6.4.1.4.3 Academic setting

Culture and the environment were frequently mentioned by participants as barriers. Some participants expressed that a cultural change within higher education was needed. This would allow metacognitive strategies to be embedded across entire programs and departments, not just by individual staff. This cultural change would require buy-in from educators also, as many might prefer their old way of teaching. Others expressed concern about how students use memorisation and rote learning techniques instead of applying metacognitive strategies. Some participants described the passive teaching and learning environments that may exist in some universities. The physical environment or learning spaces for students was criticised by some participants as not being conducive for metacognitive strategies and collaborative group work.

6.4.2 Facilitators

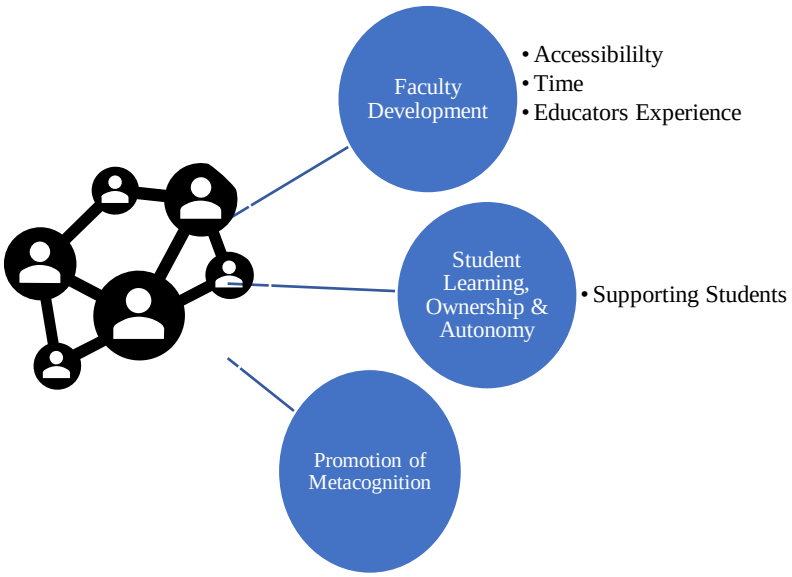

Figure 6.2: Facilitators to the development and utilisation of metacognitive teaching strategies.

Table 6.2 Facilitators to the Implementation of Metacognitive Teaching Strategies into Allied Healthcare Education

Themes	Subthemes	Quotes
Faculty Development	Accessibility	P2: “Having examples of metacognitive strategies that could be specifically effective in healthcare, athletic therapy, medical education... That would save so much time for us as educators, having to figure out, how do I teach this?”
		P3: “Sharing ideas within the institution, amongst the other institutions that deliver athletic therapy in Ireland or abroad.”
		P7: “A better understanding of what it is and how it applies in our field …a useful tool would be a kind of a repository of how people have used it before."
		P11: "Formal teaching would be important. There might be informal CPD that we should do ourselves throughout the academic year, and where we can do little informal meetups."
		P14: "I would need some formal education in what it involves and what are the tools I could use, and how I could do it."
		P2: “the support would definitely need to come from higher above us… facilitation of that would need to come from the management to show the value in it, show the ways in which could be implemented and support the staff or the educators in implementing it through providing resources, to providing time."
		P1: "I think if it was program-wide. It might have a better uptake from students because everybody is doing it, and they can see its use across multiple modules."
		P13: "I use digital technology where the students can express themselves from an anonymous perspective. It's non-consequential, and they can still learn. And they can see the thoughts of others as well, which makes them think, Oh, actually, I didn't think of that. But that's a really good point."
	Educators experience	P3: “To build up a community of practice…. So, like roundtables between the different providers in Ireland and the lecturing staff there. What do we need? How do we nurture it?... piloting things between us, or putting an emphasis on one element of the curriculum."
		P1: “A colleague recounting success that they have had with a strategy, or if you attend a talk or workshop on a particular topic that has again been shown to have success, it is always encouraging."
		P9: “There is so much to be learned from what staff do in the classroom…having conversations, opening up…Students are absolutely loving this, they're doing really well in this module. What are they doing?!"
		P5: “I'd say, the more experience you get, the more comfortable you get with teaching the content."

	Time	P2: "I believe that the more you learn about metacognition as an educator, the easier it is to implement it into different areas. Because it's not like there you will use a very different technique for this module or that module, or for learning this specific aspect…. So I guess, it might not be a huge amount of time."
		P10: "I think it doesn't require extra time in the class, and the time that it is that is given to it is going to be really valuable."
		P9: " Setting aside time that is devoted to it."
		P10: "I think it can be done subtly and easily, and I think, I'd imagine consistency is really important with it, too, like there's no point in just doing it one week, and you know and I think it, it has to be a natural fit into the class like you don't want it to be a kind of a separate thing."
Student learning, ownership and autonomy	Supporting Students	P8: "We can facilitate an environment that's open enough that the students are comfortable to go through that process and tell you where they perceive their processes to be breaking down, or where they perceive the strength and weaknesses without, being self-conscious about it...and how you can help fill those gaps from a teaching perspective."
		P3: "Knowing that you're going to generate student engagement, student enjoyment and that it's going to work very well. That it diversifies the lecture space or the teaching space and there's active participation like that's enjoyable. But it's also powerful and you can see that students when it when you do a session that goes well, you can see that people have really taken something from it. And they remember it."
		P5: "You find that students feel that they are more confident within their own knowledge or when they're in different scenarios because of the different teaching strategies that you have adopted... that would give you the drive to keep going with it or make those improvements."
		P2: "If you see your students engaging in metacognition, that's definitely a facilitator...finding ways to evaluate the progress of students, to be able to observe that it is actually makes a difference. That would be a good boost for you as an educator."
		P10: "So the nature of how we teach and deliver the classes might facilitate implementing those strategies…the practical nature of the way the athletic therapy programs are taught and delivered, that you have those smaller practical groups where you're doing discussing, reflecting."
Promotion of Metacognition		P2: “General appreciation that I mentioned earlier on... if there was a culture of using metacognition and teaching it, it would be a huge facilitator."
		P1: "If there was success shown from what has been implemented, it would give that impetus to keep it going because there has been success. It's working, students like it like it, you know."
		P7: "This is actually an educational process that will hopefully lead to some sort of journey of lifelong learning, transferable skills, other avenues if you want, or just generally improve your practice."

		P13: All these kinds of transferable skills, life skills, that's ultimately what employers are looking for...metacognition will probably play a big role in that if they can demonstrate and that they're aware of it, they'll definitely be a stronger practitioner and a more employable person. At the end of the day.
		P9: "Target those new staff coming in, tell them they have time to develop this…doing workshops or having those discussion early on …Oh what about implementing this type of thing in the classroom to teach that? Or this strategy might work there?"
		P8: "I really think that everybody would see merit in them in these strategies. Once they get over the initial challenge of implementing them regularly …I think once it becomes consistent, I think the long term adoption isn't necessarily a problem."
		P6: "So I think it is definitely something that can be applied across all aspects of education, probably even down to secondary school…they try to memorize the right answer. And then we're trying to change that over 4 years."
		P13: "A proactivity within a university to embed it, and maybe it needs like a strategy or part of a mission statement within a programme or within a school or even within a faculty as such that it needs to be encouraged."

6.4.2.1 Faculty Development

6.4.2.1.1 Accessibility

All participants expressed their desire to enhance their knowledge of metacognition and upskill in this area by undertaking professional development training, the provision of more resources, and programme wide adoption of metacognition as key facilitators for the implementation of metacognitive teaching strategies. Support by management of universities was highlighted as a facilitator by some participants. In addition, participants perceived that if management understood the benefits of metacognition, they would further encourage staff to use it within their practice and attend professional development in this area. Others suggested more national collaboration of teaching and learning techniques for allied healthcare educators. Professional development in the form of workshops or continuing professional development courses were highlighted by all participants a number of times throughout the interviews as a major facilitator in developing metacognition and strategies. Through professional development, resources and support to educators, participants felt this would aid in long term, programme wide adoption of metacognitive strategies being embedded. In addition to this, digital technology was mentioned by some as a way to possibly help integrate metacognition into curriculums and teaching practice.

6.4.2.1.2 Educators experience

Some participants reflected on the concept of communities of practice and educators peer learning to facilitate implementing metacognitive strategies into practice, resulting in enhanced confidence. Communities of practice in allied healthcare education was voiced by a few participants where all allied healthcare educators in Ireland can come together to share expertise and collaboration. Similarly, many participants noted educators' sharing their

learning experiences and exposure to metacognition further enhances the facilitation of metacognition and embeds it into teaching practice. Having intentional conversations about metacognition within the workplace and what has worked well and what needs improving was deemed very powerful for educators. Peer mentoring was mentioned by some as a way of supporting the development of metacognition in modules. Some participants expressed that having experience/exposure would provide them with the confidence to implement metacognitive strategies.

6.4.2.1.3 Time

Many participants recounted that they believed that implementing metacognitive strategies would not be too time intensive to include into their teaching practice. The implementation of the metacognitive strategies would get more time efficient the more the educators were familiar with the strategies and more frequently used in the class. Some participants stated how beneficial it would be to set aside time to develop these strategies.

6.4.2.2 Student learning and ownership

6.4.2.2.1 Supporting students

Participants expressed that through the utilisation of metacognitive strategies in their practice, they would be better able to support students through greater facilitation of learning. As a result, students would take greater ownership and responsibility of their learning by being more actively engaged in the learning process both inside and outside of the classroom. As a result of this, participants perceived students would have greater engagement and enjoyment, which would encourage educators to continue with these strategies. Participants also voiced

the need for an open environment for students to share their thinking processes, allowing students to grow in confidence and for educators to help in identifying gaps in their knowledge.

6.4.2.3 Promotion of metacognition

There was a desire from all participants that metacognitive strategies would be promoted to students and staff grounded in evidence-based literature. Participants noted the wide variety of roles that metacognition can play, from preparing students for interviews to the role it plays in clinical practice and as a clinician. In addition, educators' observing improvements in students' performance would be a motivator for educators to continue to implement metacognitive strategies into teaching practice. Overall, a general appreciation and awareness of metacognition was echoed by many participants, whereby the merit of these strategies would be encouraged to all staff, especially new staff. Through greater awareness and understanding, participants highlighted that metacognition should be embedded in all aspects of education, including secondary school to avoid the rote learning and memorisation that is currently occurring and formally acknowledging metacognition in mission statements of programs, schools and faculty.

6.5 Discussion

The aim of this study was to explore the barriers and facilitators to implementing metacognitive teaching strategies in allied healthcare education. A lack of knowledge and awareness of metacognition, time, student engagement and educational constraints were identified as barriers. Faculty development, student learning and ownership, time and promotion of metacognition were viewed as facilitators for the successful implementation of metacognitive teaching strategies in higher education in Ireland. Factors related to educating

the educator, student learning and engagement and time were considered both as barriers and facilitators to the implementation of metacognitive teaching strategies.

6.5.1 Educating the educator

By identifying the barriers and facilitators for the implementation of metacognitive teaching practices for the educator, it allows for greater understanding of their knowledge of metacognition, the educational constraints that exist and how best to overcome these barriers by faculty development and promotion of metacognition. In this current study, the majority of participants voiced that a lack of metacognitive knowledge and awareness was a primary barrier for educators for the successful implementation of metacognitive teaching practices. Coupled with this lack of knowledge, a lack of exposure was also highlighted as a barrier. Similarly, previous research found that educators' lack of metacognitive knowledge was found to be unsatisfactory for comprehensive teaching of metacognitive thinking skills (Zohar, 2006; Zohar & Barzilai, 2013), whereby 90% of science education teachers examined were unfamiliar with the concept of metacognition (Ben-David & Orion, 2013). Unsurprisingly, educators cannot teach what they do not know (Zohar, 2006; Zohar & Barzilai, 2013). If educators do not know what the strategies are, how to implement and under what conditions, therefore, its effectiveness for student learning will be not optimal (Wilson & Bai, 2010). Nonetheless, all participants in this study expressed a desire to upskill in this area by undertaking professional development training to address their metacognitive knowledge gap. Furthermore, participants stated they wanted greater provision of resources that support metacognition to upskill and embed into their practices. Professional development and training in the area of metacognitive strategies is central to bridge the pedagogical to practice gap (Ozturk, 2017; Wass et al., 2023; Zohar & Barzilai, 2013) and to facilitate ongoing peer

learning and development (McCorkle, 2021), as identified in this current study as being a major facilitator. Professional development training courses helped secondary-school teachers considerably progress in their knowledge and application of metacognitive strategies in the classroom (Zohar, 2006). In addition, metacognitive training can potentially positively impact educators' view of student learning, their own learning, and their teaching practices as a result (Wass et al., 2023).

In this current study, educators expressed a willingness to improve and embed metacognition into curricula. Many of the participants stated that metacognitive teaching practices should be adopted programme wide rather than dependent on individual educators. Participants further alluded to the development of communities of practice, peer mentoring and exposure to metacognitive practices which would aid the increasing educators' confidence in implementing them. Professional development should aim to improve and deepen not only metacognitive content knowledge, but provide opportunities for educators to gain exposure from experts enacting this knowledge. In conjunction with this, a collective participation to implement metacognition within the same department, faculty or institution through shared goals setting and opportunities to reflect on the process frequently is recommended (Ozturk, 2017). Providing a common shared language of metacognition between students, educators and fellow faculty members (Pintrich, 2002), can aid in a cultural change within a faculty and institution (McCorkle, 2021; Van Wyngaarden et al., 2024), developing communities of practice (Zohar, 2006). Building daily metacognitive habits is central to learning and equally important for educators to embed into their daily teaching practice (Wass et al., 2023), further emphasising the need for educators to be supported in this by fellow faculty members and management (Georghiades, 2004). Despite the influence of metacognition in educational and cognitive psychology literature over the last four decades, its influence in allied healthcare

education remains limited. A theory to practice gap may be evident which is unsurprising given the lack of metacognitive awareness and implementation among higher education educators (Dennis & Somerville, 2022). Therefore, the accessibility and provision of professional development training and resources in metacognition is needed for higher education educators nationally and internationally to bridge the gaps that exist currently for the successful implementation of this essential higher order cognitive skill. In addition, future research should seek to explore the efficacy of the metacognitive training and subsequent implementation into practice.

Educational constraints were identified as a major barrier towards the implementation of metacognitive practices in allied healthcare programs in Ireland including; overloaded curriculums, metacognition being a difficult concept to teach, and educators' lack of formal training in education coupled with a traditional didactic culture of teaching and the traditional tiered lecture spaces. Despite the identified barriers in this study, the promotion of metacognition was viewed as a major facilitator to overcome these barriers. Facilitators included evidence-based practice, changing the culture and perceptions of both staff and students regarding learning through all stages of formal education in Ireland, embedding metacognition into all aspects of curricula and professional training for educators. Educators' beliefs and perceptions can have a profound impact on their teaching and learning practice. Hence, shifting from lecturer to facilitator can be challenging for some educators who may be more familiar with the traditional model of teaching as a result of past experiences during own time as a student (McCorkle, 2021). Changing the culture in classrooms from a "pedagogy of knowledge transmission" (Zohar & Lustov, 2018 p88), to more active based metacognitive activities is needed (Wass et al., 2023). In addition, for the successful adoption of metacognitive strategies into allied healthcare education, policy makers and management need

to make changes in the institutional culture to teaching and learning, which will then lead to curriculum changes to facilitate this, by providing more time and flexibility inside and outside the classroom for metacognitive development (McCorkle, 2021; Zohar & Barzilai, 2013). As a result, metacognition requires active engagement and practice (Wilson & Bai, 2010), which involves all key contributors', faculty, educators and students. Moreover, this calls for a transformational cultural change and reform in higher education in Ireland to occur, promoting all pedagogies, inclusive of metacognition, to enhance student learning and educational practice.

6.5.2 Student learning and engagement

Student engagement and "buy-in" were identified by participants as barriers to the implementation of metacognitive teaching practices. However, educators in this current study reported that by supporting students to use metacognitive practices, student engagement increases. Fostering social metacognition within the classroom through collaborative group work encourages students to take ownership of their learning as they share their thinking and ideas with peers in a safe environment (Stanton et al., 2021). This in turn enhances educators' enjoyment and a desire to continue using these strategies as a result, as evident in the findings of this study. This further increases both students' and educators' confidence in applying metacognitive practices to their teaching and learning practice (Karlen et al., 2023). Despite this, a potential challenge remains for educators to get students to understand the benefits of metacognition as a way to enhance their learning, as students have traditionally been rewarded for being passive learners (Ben-David & Orion, 2013). However, this can be achieved by promoting metacognition's positive correlation with academic performance and that it is the second strongest predictor of learning (Ohtani & Hisasaka, 2018; Wang et al., 1993). However, changing students' perceptions and expectations of learning in higher education can be

challenging as typically students prefer to be passive in their participation, and to memorise information rather than apply higher order metacognitive and critical thinking skills during active learning tasks (Van Wyngaarden et al., 2024). Furthermore, students need to be explicitly taught the benefits of metacognition in aiding their academic performance (Biwer et al., 2023), and ultimately their clinical reasoning skills and patient care (Cale et al., 2023). Metacognition is an active process that requires engagement and practice (Wilson & Bai, 2010), hence student engagement is necessary for successful learning to occur. Further research is needed in student cohorts to identify how to encourage meaningful and lasting engagement.

6.5.3 Time

Time constraints were highlighted by participants, in particular, the preparation time required to set up these teaching strategies. Contrastingly, many participants also said that they perceived them not to be too time intensive. In addition, they said that with time, they would become more efficient in using them in class. A time investment from an educators' perspective is required to develop and refine these metacognitive teaching strategies and then to teach these metacognitive skills to students (Gamby & Bauer, 2022; McCorkle, 2021; Van Wyngaarden et al., 2024; Zohar & Ben-Ari, 2022), as it is complex, tacit and invisible cognitive skill to teach (Avargil et al., 2018). Nevertheless, this should be weighed up against the benefits of teaching metacognition to students and the potential enhancement in academic performance, namely more effective and efficient clinical reasoning skills in allied healthcare student professionals. In addition, it adds to the evidence pertaining to enhanced self-regulatory skills for lifelong learning (Karlen et al., 2023).

6.5.4 Limitations

The findings of this study are contextual to higher education and can inform teaching practice of allied healthcare educational programmes in Ireland; its generalisability remains

unknown to other disciplines both nationally and internationally. Despite this, key learnings could be applied to other domains. Interviewer bias is possible, due to the researcher's in-depth analysis of current literature and professional background experience in higher education, they may have been aware of potential barriers and facilitators prior to data collection. To reduce such bias, the interview guide was followed to focus the interviews. In addition, the voluntary nature of the semi-structured interviews allowed for the participants to share their perceptions of barriers and facilitators of implementing metacognitive teaching strategies into their practice, without knowing what the researcher's thoughts and perceptions were. Furthermore, participants were most likely to participate if they were interested in metacognition or teaching pedagogies.

6.5.5 Future directions

Future research should explore the cultural and environmental aspects involved in embedding metacognition into allied healthcare programs, acknowledging the barriers and facilitators to this. Additionally, future research could explore ways in which professional development training in metacognition can be facilitated for educators and faculty members in higher education and the effectiveness of this training. Future research should seek to explore the students' voice, understanding metacognition and the adoption of metacognitive teaching strategies from their perspective. The efficacy of implementing metacognitive teaching practices requires investigation, both from educator and student perspectives. Finally, future investigations could examine the establishment of best practices in the development and implementation of metacognition in higher education institutions, adopting faculty and institution wide policies on metacognition.

6.6 Conclusions

Metacognition plays an essential role in the enhancement of student learning and performance and, in particular, the development of effective and efficient clinical reasoning in athletic therapy and allied healthcare educational programs. Metacognition is not a skill to be taught, but rather a way of thinking and learning (Wilson & Bai, 2010). The findings of this study highlight barriers such as a lack of knowledge and awareness of metacognition, time, student engagement and educational constraints. There is a desire to overcome these barriers through the identification of many known facilitators, such as educating the educator, supporting student learning and engagement, and facilitating time to implement these metacognitive teaching strategies into practice. Professional development pedagogical training, resources and encouraging student engagement is essential for the development and implementation of metacognition into teaching practice.

Summary of Chapter 6 and its link with chapter 7.

The findings of Chapter 6 confirm educators' desire and willingness to integrate metacognition within higher education classrooms, as they value the role of metacognition to aid learning. The findings provide an in-depth and detailed look at educator's perceptions towards the barriers and facilitators to implementing metacognitive strategies within higher education, as supported by findings in chapter 2. Therefore, in chapter 7 we propose practical recommendations that take in account the barriers and facilitators from chapter 6. In addition, we propose a framework to enhance metacognitive awareness within athletic therapy education based on the findings of Chapter 4, 5 and 6, and supported by the existing literature on metacognition.

Chapter 7: Recommendations to Facilitate the Development of Metacognition in Athletic Therapy Education.

Chapter 7: Recommendations to Facilitate the Development of Metacognition in Athletic Therapy Education.

Acceptable for publication in the International Journal of Athletic Therapy and Training.

7.1 Introduction

The development of metacognition is imperative for the enhancement of academic and clinical performance. The findings of this research highlight that Irish athletic therapy students demonstrated moderately good metacognitive awareness across the four years of their undergraduate programmes. However, educators' awareness and implementation of metacognitive teaching strategies within their practice for the promotion of students' metacognitive approaches to learning were varied and inconsistent. Therefore, emphasising that educator training in this area is needed. To facilitate and encourage the implementation of metacognition in athletic therapy education, we propose a 5E best practice conceptual framework for educators to facilitate the successful adoption of metacognition into athletic therapy education. These recommendations have been peer-reviewed by two experts in athletic therapy education and metacognition and refined based on this feedback. The five steps of the 5E conceptual framework are: **E**ducation, **E**xposure & experience, **E**ncourage experimentation, **E**nabling engagement and **E**xplicit embedment (Figure 7.1).

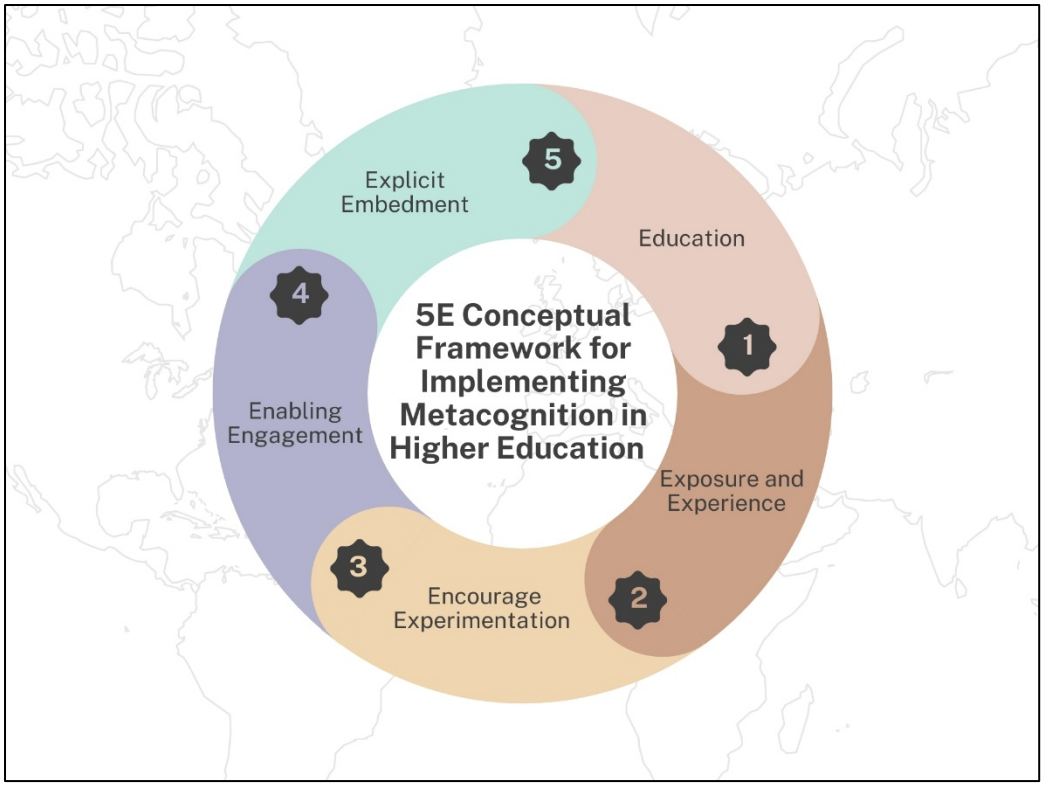

Figure 7.1: 5E best practice conceptual framework for the adoption of metacognition into athletic therapy education.

This framework can be adapted for all disciplines for the implementation of metacognition into educational practice, but the focus here will be on athletic therapy education. All 5 components of the framework are interconnected and interdependent on each other. **Step 1: Education.** Education in metacognition is needed through professional development training for all key contributors, including educators, students and faculty. Education is the primary and fundamental phase in the framework. It is essential for the advancement and transformation of athletic therapy educational practice, through implementing and embedding metacognition throughout all aspects of the curricula. **Step 2: Exposure and experience.** Exposure and experience of metacognitive teaching strategies is dependent on educators' knowledge and awareness of metacognition, aided by professional

development training. **Step 3: Encouraging experimentation.** Encouraging experimentation will occur as a direct result of educators' sound metacognitive education, exposures and experiences. This will provide them with both theoretical and practical knowledge and resources to experiment when implementing metacognitive strategies into their teaching practice. **Step 4: Enabling engagement.** Enabling engagement allows educators to create a metacognitive teaching and learning environment for students to learn how to use metacognitive strategies both inside and outside the classroom, empowering students to become better independent learners. Engagement of all key contributors' is imperative for the successful adoption of metacognition within a programme. **Step 5: Explicit embedment.** Explicit embedment of metacognition into athletic therapy curricula allows educators to formally and informally develop students' metacognitive awareness. Cultivating a metacognitive lens towards teaching and learning does not occur automatically. A sequential approach inclusive of all the 5E components is recommended; education, exposure, experience, experimentation, enablement and engagement. This 5 E best practice conceptual framework continually evolves as educators' knowledge and confidence grows in this sustainable educational model.

7.2 Recommendations

7.2.1 Education

7.2.1.1 Educating the educator

Educators' understanding, perceptions and implementation of metacognition within athletic therapy education is of significant importance in facilitating student learning. To address educators' varying levels of knowledge about metacognition, we recommend that

educators undertake professional development training in this area. This was apparent in the findings from Chapter 5 and 6, where many educators in higher education lacked professional training in best practices for teaching and learning. An overall emphasis of this professional development training should include the purpose and role of integrating metacognition into higher education, practical applications of how to implement metacognitive teaching strategies, and how to assess metacognitive development for successful student learning, as shown in Table 7.1. I suggest that this training involves 5 workshops days (2 full and 3 half days), over the course of an academic semester to complete. The training should involve the practical applications of metacognition by educating on 1) how to model metacognitive thinking, 2) how to scaffold students' thinking to be effective when encountering complex clinical cases, 3) how to design and use metacognitive teaching strategies within modules and curriculums, and 4) how to provide opportunities for students to discuss and articulate their thinking and provide feedback on their metacognitive thinking.

Table 7.1: Sample Professional Development Training Programme in Metacognitive Teaching Practices

Professional Development Training Programme in Metacognitive Teaching Practices for Educators.	
Programme Aims:	This programme will provide participants with an opportunity to develop key learnings in metacognition, underpinned by educational research. The programme will provide a conceptual framework and strategies for the teaching and assessment of metacognition to improve student learning.
Programme Objectives:	Explain the benefits, limitations and practical solutions for fostering metacognitive approaches within athletic therapy education.

	Apply the 5 E conceptual framework to design and implement teaching sessions that promote metacognitive awareness among students and educators.	
	Incorporate authentic metacognitive strategies into their teaching practices.	
	Design and evaluate metacognitive assessment techniques that promote student learner engagement.	
	Create cohesive learning experiences that promote metacognitive development supporting effective lifelong learning and agile practitioners.	
	Engage with a community of educators in higher education in a process of continuous professional development.	
Session Aims and Objectives		**Educator Activity Tasks**
Session 1 **Full day workshop** **Education**	Introduction and background to metacognition.	Ask educators to write down what metacognition means to them.
	Audit of current teaching and assessment practices.	Individually, then in small groups and feedback to the main group.
	In class activity using Lego, educators will build a rehabilitation and performance gym (limited facilitator input and instruction).	Discuss and demonstrate limitations in task completion without metacognitive prompts and input.
	Contextualise evidence-based literature supporting metacognition to aid academic performance and lifelong learning.	Ask educators self-reflective and socratic questions regarding evidence-based knowledge about metacognition.

	Discuss clinical relevance of metacognition to enhance clinical reasoning skills.	In small groups and provide feedback to the main group.
	In class activity using Lego, educators will build a rehabilitation and performance gym (collaborative facilitator and learner input and instruction).	Discuss and demonstrate the use of metacognitive scaffolding in task completion.
	Overview of metacognitive teaching strategies. For example; educator and student think alouds, checklist/prompts, concept mapping, Concept Test, socratic questioning, confidence ratings, self-reflective activities, role modelling.	Discuss in small groups the benefits, limitations, and methods to adding metacognitive teaching strategies into practice.
	Direct educators to use virtual learning environment (VLE) resources and tasks.	Write a self-reflective post on VLE on metacognition. Peer feedback on posts required.
Session 2 **Full day workshop** **Exposure and Experience**	Translate workshop learning into clinical teaching practice.	Discuss the 5 E conceptual framework.
	In-class activity using role-playing of a metacognitive teaching strategy.	Discuss role-play scenario, sharing reflections.
	Choose one teaching or clinical skill, design a metacognitive teaching strategy to support this skill.	Discuss and get feedback on the proposed strategy in small groups. Evaluate the requirements needed to make this successful and implement it in class before session 3.

	Design an authentic class programme using metacognitive teaching strategies and assessments using the CASCARA approach to the evaluation of metacognitive strategies (Figure 7.2).	Share reflections with the small groups and provide peer feedback.
	Implement a metacognitive teaching strategy in your classroom.	Fellow educators to complete one peer observation and evaluation after session 2.
Session 3 **Half day workshop** **Encouraging Experimentation**	Discuss the implementation of metacognitive strategies in your practice since session 2.	Share reflections with the small group and provide peer feedback.
	Design a modular approach to metacognition.	In small groups and provide feedback of the main ideas to the main group.
	Design assignment briefs and rubrics with a metacognitive focus.	Upload 1 assignment brief for review onto VLE. Fellow educators to provide peer feedback.
	Implement a new metacognitive teaching strategy in your classroom.	Fellow educators to complete one peer observation and evaluation after session 3.
Session 4 **Half day workshop**	Discuss the implementation of metacognitive strategies in your practice since session 3.	Share reflections and evaluations within the small group and then the main group.
Enabling Engagement	Discuss class and educator engagement to the implementation of metacognitive strategies.	Share reflections with the small group and then the main group.

	Discuss VLE and how to utilise this more to increase engagement.	Share reflections of educators using VLE, providing peer reflections.
Session 5 **Half day workshop** **Explicit Embedment**	Implementing a curricular approach to metacognition for a programme.	Share reflections with the small group and then the main group.
	Discuss strengths, limitations and solutions of the adoption of metacognition within a programme and university wide.	Share reflections with the small group and then the main group.
	Set up a community of practice and establish mentors for metacognitive practice in your university.	Become a metacognitive mentor.

VLE- Virtual Learning Environment.

The assessment of metacognition remains a challenging aspect for researchers and educators both in theory and practice due to the highly subjective and individual nature of metacognition. Educating educators on the best available metacognitive assessment tools and examples of how best to integrate them into practice is necessary. An example of metacognitive assessment tools used in a clinical scenario are listed in Table 7.2. Each of the eight theoretical components of metacognition are mapped to different aspects of the subjective and objective clinical assessments of a patient, during a clinical encounter whereby the educators can use specific metacognitive assessment tools to enhance student learning.

Limited assessment tools exist and as a result their repeatability and reliability are very restricted. The most commonly used assessment tool is the metacognitive assessment inventory (MAI). However, this tool is used to self-assess an individual's awareness of metacognition. The MAI can be used to assess metacognitive awareness of both students and educators. Educators can assess metacognitive awareness and abilities in their students when they embed

metacognitive strategies within their practice and module(s) by using tools, such as think-aloud protocols during clinical encounters, socratic questioning and/or reflective journaling and assignments (Fleur et al., 2021; Ohtani & Hisasaka, 2018; Song et al., 2021; Veenman, 2013). These methods for assessment are arguably very subjective and very time intensive for educators, however, they provide individualised or small group feedback to students about their learning and academic performance. I recommend that educators undertake these strategies as often as possible, integrating this with verbalising and making explicit their own thought processes. I also recommend that future research explores different ways to assess metacognition, such as integrating critical reflections on learning to help students to self-evaluate their approaches and provide educators with an insight into their learning and performance, as this is lacking significantly in the literature. This research will also help support educators to objectively evaluate the success of implementing metacognitive strategies in their own practice.

Table 7.2 Assessment of Metacognition in a Clinical Scenario.

Assessment of Metacognition in a Clinical Scenario	
Declarative knowledge assessment	Students ability to demonstrate good sound theoretical knowledge of the "what of knowledge" regarding the musculoskeletal injury (e.g. pathophysiology of injury, clinical presentation).
Procedural knowledge assessment	Students ability to demonstrate the "how of knowledge" regarding the musculoskeletal injury and demonstrates safe and effective clinical testing procedures and practice (e.g. epidemiology of injury, mechanism of injury, safe manual handling and hands-on techniques).

Conditional knowledge assessment	Students ability to demonstrate the "when and why of knowledge" regarding the musculoskeletal injury (e.g. time, space, place injury occurred, good theoretical understanding and explanation of why it occurred during questioning by educator/clinical supervisor).
Planning assessment	Students ability to demonstrate good planning of subjective and objective examinations through careful considerations of ordering of clinical testing procedures and questioning of a patient.
Information management assessment	Students ability to demonstrate reflection by establishing if enough clinical information was gathered during the clinical encounter, through questioning of the student by educator/ clinical supervisor.
Monitoring assessment	Students ability to demonstrate good self-testing and monitoring ability of a patient during a clinical encounter to establish if progress is being made (e.g. during a treatment technique or rehabilitation exercise).
Debugging assessment	Students ability to demonstrate they can intentionally look for discrepancies or errors through meaningful self-reflective questions (e.g. what went well, what did not go well and what can I improve on for the next time).
Evaluation assessment	Students ability to demonstrate critical appraisal of their performance during a clinical encounter by self-marking, in addition to the educator/clinical supervisor providing a mark on their clinical performance during the clinical encounter.

Additionally, I recommend that educators understand their role in facilitating students' learning experiences. This could be supported by modelling their thinking and making it visible for students to learn from. Training should provide educators with resources and examples that they can implement immediately in class with students. In addition, I recommend that professional training be supported to facilitate educators in attending and completing these training sessions, otherwise it becomes an additional task for educators to do, with less likelihood of it being implemented in a sustainable and long-term model. From the findings in chapter 5, education in this area is imperative, as some educators are implementing metacognitive teaching strategies within their practice without having strong evidence-based knowledge or understanding on what they are trying to achieve. The publication of teaching and learning booklets/infographics on how to teach metacognitively in higher education will significantly aid this. Furthermore, educating and mentoring new educators, especially those new to higher education, in metacognitive techniques to aid their classroom teaching is also recommended. I recommend that educators use the newly devised CASCARA (comprehensive, accessible & adaptable, student engagement, contextual, assessment, real-world application, active participation) that we developed to approach the evaluation of metacognitive strategies as shown in Figure 7.2, to review, reflect and evaluate all educational resources, ensuring suitability and effectiveness of metacognitive development.

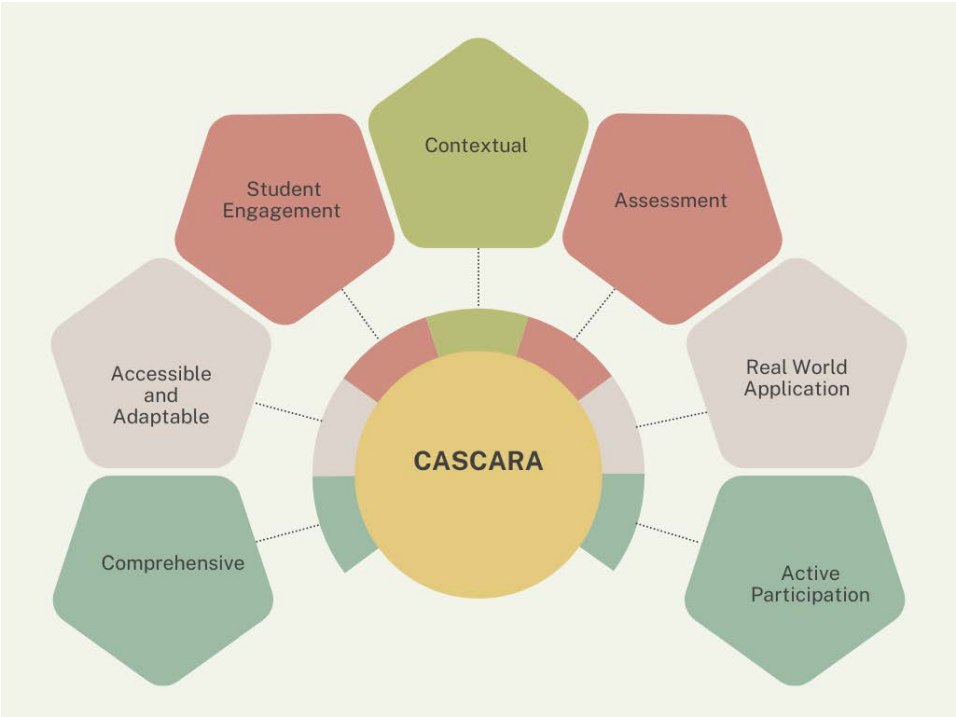

Figure 7.2: CASCARA Approach to the Evaluation of Metacognitive Strategies

All metacognitive teaching strategies should aim to encompass the following; 1) Comprehensive – targeting the two main components of metacognition, namely knowledge of cognition and regulation of cognition. 2) Accessible and adaptable – educators can integrate and adapt these metacognitive strategies to fit different teaching formats or settings to be appropriate for their student cohort needs. These strategies should be easy to administer and suitable for students of all intellectual abilities. 3) Student engagement – strategies that create and sustain student buy-in and interest. 4) Contextual – strategies that can be used in various contexts, yet be adaptable to specific aims of module design and content or programme learning outcomes. 5) Assessment – to be used in multiple ways, and that assessments are complex enough for students to need to use metacognitive strategies to be successful, from formal summative examinations to informal formative class assessments. 6) Real world application – discipline-specific, addressing specific knowledge concepts pertaining to athletic therapy

education. 7) Active participation – students' participatory involvement, increasing engagement and supporting peer learning.

7.2.1.2 Educating the student

Similarly, students will benefit from metacognitive training. I recommend that students become educated on the benefits of metacognition for learning, academic performance, clinical performance in a dynamic clinical environment and lifelong learning. A critical component of metacognition is the ability to reflect, and we recommend that students are taught how to self-reflect by providing them with guidance and feedback on how to meaningfully and critically self-reflect. In addition, I encourage students to self-evaluate their learning and performance during assessments and give guidance on how to complete peer reflections. We recommend educators facilitate classroom time for self- and peer-reflections and signpost students on how to do this effectively. I emphasise that students should be encouraged to take time to think about their thinking and how they apply their knowledge and learning to different situations through pre- and post-assessments. Pre-assessments allow students to examine their current or prior knowledge whereas post-assessments allow them to recall what they learned about a topic and compare it to prior knowledge after completing a task and to establish if their thinking has changed and why. Educators can facilitate this by allowing five to ten minutes at the beginning and end of each class or unit of curricular content to allow students to complete pre- and post-assessments. I recommend students start to build in self-testing as a habit when learning independently, using both pre- and post-assessments. Additionally, I recommend educating students on the benefits of metacognition so that they will be more engaged and motivated, through using real world examples of how it has helped the educator in a relevant setting to what is being taught, which can result in students taking greater ownership of their learning, which in turn could promote enhanced self-efficacy and a growth mindset.

7.2.1.3 Educating faculty and the wider university

Without education directly informing faculty and university contexts, implementation of metacognition may not be prioritised. Therefore, I recommend that universities and faculties place a greater appreciation and value on metacognition, in the same way as we highly value critical thinking skills as attributes for students and graduates of universities. We need to emphasise to university staff and management how interrelated metacognitive and critical thinking skills are and acknowledge the vital role metacognition plays in developing critical thinking. We need to explicitly emphasise the need to develop metacognition in future graduates, to ensure they are competent, critical, and metacognitive thinkers. A typical list of graduate attributes by Irish universities include: problem-solving skills, analytical skills and critical-thinking skills. However, I recommend that metacognitive thinking skills be promoted, recognised and explicitly added to this list of attributes by universities, due to its importance and interrelatedness to these attributes. In addition, I recommend that universities and faculties create policies and practices that support a metacognitive teaching and learning culture, subsequently supporting both educating the educator and educating the student. Furthermore, this will require reforming and transforming educational practice, moving away from traditional didactic teaching to more active participatory teaching practices that require collaborative learning where the educator becomes the facilitator. By educating university management on the benefits of metacognition for student learning, educators should be supported to attend training in this area and provided with the resources needed to implement these teaching strategies. Physical resources, such as the teaching space, should be evaluated with university management, moving away from the traditional tiered lecture space to more open roundtable environments that support collaborative and peer learning. Having pens and flip-boards in each of these rooms helps facilitate

discussions and generate ideas for positive learning experiences. In addition, providing educators with a list of easy-to-use in-class metacognitive strategies, such as the muddiest point or one-minute papers, will benefit the implementation of metacognition in the classroom. Providing educators with access to various active learning digital technology applications is also imperative for successful embedment.

As a result of this shared commitment to implement metacognitive strategies, we recommend that a community of practice is established and supported by university management. We encourage universities to champion educators who are interested in this field by allocating research funding towards developing expertise in this domain in Ireland. In addition, we recommend at least one educator or faculty member per programme to become a metacognitive mentor or champion. As a result, they will highlight new evidence-based innovative teaching practices to their fellow educators, that aids in metacognitive development as the research progresses in this field. Alongside this, we recommend universities embed a module (or part thereof) into year 1 that teaches students explicitly how to learn and study effectively in preparation for examinations and lifelong learning, and emphasising metacognitive thinking skills. Furthermore, we also recommend that metacognition is not just part of one module, but it is a cross-curricular skill that is developed consistently across multiple modules throughout the four years of their undergraduate training. It should be well defined and explicit in curricula, targeted through rubrics in assessments as an additional component and consistently used on all, if not the majority, of modules on athletic therapy programmes.

7.2.1.4 Educating the professional accrediting governing bodies

In Ireland, Athletic Rehabilitation Therapy Ireland (ARTI) is the professional governing body responsible for the promotion, regulation and continued education of certified athletic therapists. There are currently three ARTI-accredited universities teaching and training athletic therapists in Ireland. As part of this, ARTI has a set of educational competencies that accredited universities must comply with. The accrediting governing bodies of athletic therapy and training internationally have a role and a responsibility to promote metacognition. We recommend that ARTI review their educational competencies and explicitly state metacognition as part of the overall learning outcomes required by graduates of ARTI accredited programmes. We encourage that where clinical reasoning skills and/or reflective practice is stated as part of an educational competency, this should include the addition of metacognitive skills as well, due to their interdependence. This will encourage universities and faculty to apply metacognition to their programme learning outcomes, hence facilitating educational change and practice.

7.2.2 Exposure and experience

Following on from education, educators will continue to complete their metacognitive training workshops to build their exposure to the practical implementation of metacognitive teaching strategies that can be used in the classroom or virtual learning environment that will be beneficial to students' metacognitive thinking and learning. As a result, during these educational exposures, educators become the student, giving them a different perspective and lens to view these teaching strategies through, enabling them to wear both the educator and the student hats during these experiences. In this context, educators will be able to identify any pitfalls, misconceptions or barriers that their students may encounter during a class session,

allowing time for the educator to reflect and refine the strategies to suit the class session, cohort and physical environment that they will be teaching in. Through implementation, the students' voice becomes increasingly important. We recommend that educators' value this and ask students to critically reflect on these new teaching strategies to evaluate their effectiveness after set time periods during the semester and academic year, to allow for modifications to occur for both educators and students by undertaking evaluative questionnaires and focus groups. As a result, students will most likely be willing to engage with the process, if they feel their voice is being heard and they are part of this collaborative teaching and learning environment. Additionally, we envisage that through increasing exposure and experiences of metacognition, both educators and students will increase their confidence and self-efficacy with it, as evident in the findings of this study. Educators' confidence to commit to this change in teaching pedagogy will be enhanced, while students may turn to applying more metacognitive strategies to aid their learning versus traditionally rote learning techniques. Furthermore, we recommend programmes and faculties adopting metacognition as part of their programme curricula, building communities of practice with other like-minded fellow educators. This will allow educators to collectively discuss ideas, their experiences, any issues related to metacognitive practice and professional development in this area, further progressing the development of metacognition within higher education and athletic therapy education.

7.2.3 Encourage experimentation

Through education, followed by exposure and experience, educators will become more confident to experiment with the different strategies to aid students' metacognition. I encourage educators to be creative and innovate in what works for them, their student cohort, modular design and curriculum. I recommend that they use the supports and resources available to them to facilitate this experimentation. Only through experimentation and evaluating students'

perceptions and values, will educators be able to establish the effectiveness of the strategy, further progressing the field of metacognitive evidence-based research. Some examples of how educators may integrate metacognitive examples into their practice are shown in Table 7.3.

Table 7.3: Sample Integration of Metacognitive Task into the Athletic Therapy Classroom

Sample Integration of Metacognitive Task in the Athletic Therapy Classroom		
Overview of Task	**Metacognitive aims and components**	**Resources needed**
1. Educator starts class with a pre-assessment of prior knowledge of a topic (e.g. 5 MCQ's on acute ankle injuries or asks 5 questions where the answers form a word cloud).	This aims to establish students' prior knowledge or declarative knowledge, in an interactive format.	Online digital audience engagement tool that allows students to answer multiple choice questions (MCQ's), short answer questions and polling questions.
2. Educator instructs and facilitates students to complete a concept map in small groups or individually on acute ankle injuries.	Small group work helps facilitate peer discussions and group/peer collaborative learning.	Flip boards, pens, markers, roundtables. Digital online graphic apps can also be used.
3. In small groups students start to plan, organise and draw/create their concept map.	Concept maps help students organise their knowledge, plan and visually display this knowledge succinctly in a graphic formation. Concept mapping helps as an	

	information management strategy to represent content knowledge.	
4. During the task students will need to think aloud their clinical knowledge to their peers, in particular their case pattern recognition of the pertinent subjective and objective information. The educator can facilitate discussion, stimulating students' thinking and signpost students to particular pertinent content, if missing.	Think-aloud protocols helps students to articulate their thinking, and consciously monitor and evaluate their learning and that of their peers.	
5. Students will then present their concept map to the rest of the class. During this time the educator will facilitate and ask socratic questions based on the information presented on the map.	This will provide students an opportunity to reflect on their map, think aloud their clinical reasoning and knowledge. It will provide fellow students an opportunity for peer feedback. In addition, it allows students to summarise their findings and self-evaluate their performance. It	

	provides an opportunity for the educator to provide feedback also.	
6. End the session by students completing a post-assessment MCQ or short answer questions on acute ankle injuries. In addition, the educator can get students to answer what they believed to be the muddiest point (most confusing aspect /concept of the material covered today).	This provides both students and educators with an awareness of their understanding of the concept of acute ankle injuries. Identifying gaps in their knowledge that can be addressed outside the classroom through further activities or reading in the virtual learning environment.	

7.2.4 Enabling engagement

Enabling all key contributors to be educated in metacognition is essential to allow for the implementation of metacognitive strategies within a module, programme, faculty and/or university. A key component of metacognition is the articulation of an individual's thinking. Hence, I recommend that students are enabled to vocalise their thinking by sharing their knowledge, their confusions or their weakness in a safe and supportive classroom environment.

This allows educators to address any discrepancies, paying less attention to the correct answer and more time fostering a metacognitive classroom culture. Through this enablement of students' thinking, students will progress in their academic content learning and assessment. In addition, we recommend that educators are provided with the relevant time, resources and support needed to implement these changes to educational practice.

Having buy-in and engagement of all key contributors is of utmost importance for the successful adoption of metacognition into athletic therapy programmes nationwide. Metacognitive classrooms need to be inspiring and engaging for students who wish to undertake the necessary pre- and post- classwork required and to participate fully during the class session. As a result of this, educators need to be dynamic and adaptive to the needs of the classroom, by asking reflection-in-action questions such as "what could I do right now to improve the class session?" I recommend that metacognition is socially shared, whereby students share ideas and thoughts with their peers and invite their peers to evaluate their shared ideas, working together in small groups. This shared metacognition allows students to get fully immersed with the process, furthering and strengthening their engagement in their own learning, taking ownership for it. Equally, educators can share their thoughts on how they implemented metacognitive strategies within their practice, recounting the facilitators and barriers in doing so, helping metacognition become part of the normal language used in higher education.

7.2.5 Explicit embedment

Currently in Ireland, secondary school education still maintains a culture of rote learning, especially in senior cycle, in preparation for the Leaving Certificate. Some educational reform has taken place in the junior cycle; however, such reform is yet to be

approved for senior cycle. As a result, students enter higher education with a focus on approaches to learning that may not be the most effective and efficient to develop metacognitive thinking and subsequently, clinical reasoning. I recommend that first year students in higher education, including athletic therapy students complete a module (or part thereof) on best strategies and techniques to aid learning. As a result, this will enhance their metacognitive awareness and academic performance. It is envisaged that the longitudinal integration of metacognitive practices will positively influence students' ability to transfer learning from one context to another, as metacognition is foundational in how an individual thinks and learn, considering the reflective and regulative components of metacognition. Thus, embedding metacognition as a fully immersed, cross-curricular concept embedded into modular learning outcomes and formative and summative assessments instead of a bolt-on component to a module, is essential to the integration and transformation of learning in athletic therapy. I encourage that metacognition becomes part of the everyday language of the classroom, used by both educators and students, where there is a shared understanding of metacognition. Additionally, I emphasise that metacognition is embedded as early as possible into programmes, furthering the continuous and consistent daily metacognitive use that is central to learning. This commitment to embed metacognition into all or the majority of modules in a programme and faculty, encourages a sustainable model of education. Metacognition helps students acquire and utilise a sustainable model of thinking and learning, that will support their future lifelong learning as a clinician and can be used in all aspects of their lives, not just academia.

7.3 Conclusion

The one key concept which underpins all of the above conceptual components is education. Education is the cornerstone in which this framework can be achieved. Without

educating all key contributors, including students, educators, faculties/universities and governing bodies, true implementation and subsequent embedment of metacognitive practices will not take place. Figure 7.3 provides an overview of the framework to aid all key contributors in utilising metacognition within AT education to the fullest. Future evaluation by students, educators and faculties/universities of these strategies is needed to further progress metacognitive development and embedment in higher education. I believe metacognition must become an indispensable component to athletic therapy education.

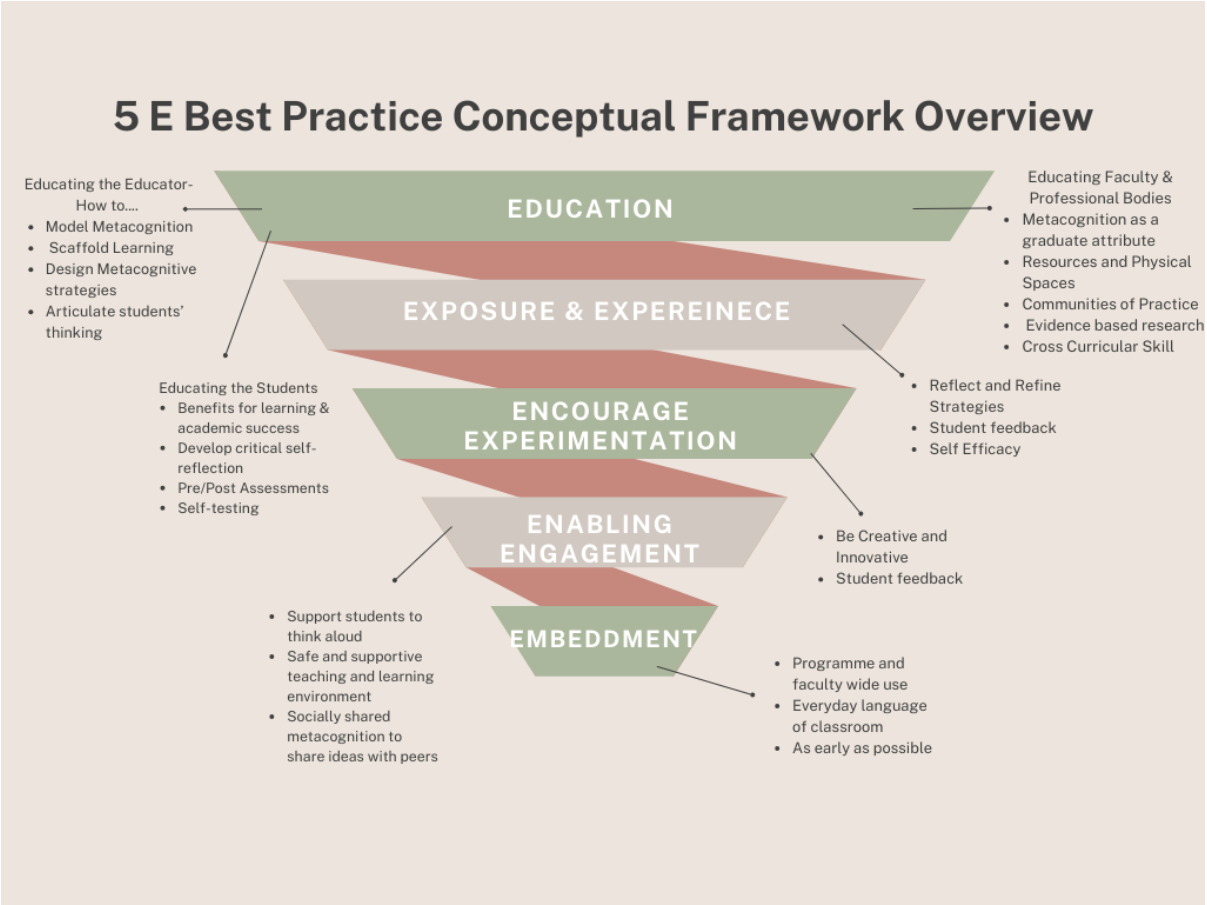

Figure 7.3 5E Best Practice Conceptual Framework Overview

Chapter 8 General Discussion

Chapter 8 General Discussion

8.1. Introduction

The overview of the current literature presented in Chapter 2 explained the cognitive processes at play during clinical reasoning and the interrelatedness and interdependence of clinical reasoning and metacognition were explored. Clinical reasoning relies on case pattern recognition and hypothetico-deductive reasoning, fundamental to this is metacognition, encompassing knowledge of cognition and regulation of cognition to reflect, monitor and evaluate knowledge, for effective patient care. Therefore, clinical reasoning is the linkage between metacognition and the development and application of clinical knowledge within the patient's contextual environment (McDevitt et al., 2019). As a result, clinical reasoning necessitates that clinicians and students utilise specialised medical knowledge and skills to identify the clinical problem, while also employing metacognitive processes to organise, monitor, and assess their thinking processes (Wang et al., 2023). Educators play a significant role in the development of students' learning and in particular their clinical reasoning skills. Therefore, to gain a better understanding of the role of metacognition in athletic therapy education, I explored the role of metacognition in Irish educators and found that it was the forgotten facet in athletic therapy education. As an educator working in higher education for over a decade, it was critical for me to better understand how to optimise my teaching practice to enhance my students' learning and how best to support them to be competent, highly skilled future clinicians in the athletic therapy profession. Recognizing the necessity for research in this area, in particular in higher education, both from the students and educators perceptive, as outlined in Chapter 2, the overarching aim of this research was to examine the role of metacognition in athletic therapy education.

8.2 Learnings for practice

Addressing the aims of this research, an examination of athletic therapy student learners' metacognitive awareness was undertaken in chapter 4, athletic therapy students from all four undergraduate years in ARTI-accredited universities in Ireland demonstrated moderately good metacognitive awareness. This suggests that there is an opportunity to enhance metacognitive awareness and ability, which can be achieved by the explicit teaching of metacognition both inside and outside the classroom. Establishing the level of metacognitive awareness which students possess is essential in enabling students to tailor specific learning strategies to aid in their academic and clinical performance. However, in order to improve metacognitive levels in athletic therapy students, it was imperative to explore allied healthcare educators' awareness, understanding, and inclusion of metacognition in their teaching practice, which was an additional aim of this research.

In chapter 5, the findings suggested that many educators had heard of metacognition and consequently, had varying levels of understanding and implementation of metacognitive teaching strategies within their practice and of a willingness to implement it. As a result, there is a need for greater in-depth and robust understanding of metacognition as a framework to aid learning. As previous literature has stated, it is important that educators understand metacognition due to the vital role it plays in student learning and academic achievement (Ohtani & Hisasaka, 2018). In order for this to be achieved, educating all contributors about metacognition and metacognitive teaching strategies to augment this in athletic therapy education is needed, for the successful embedment into modules, curricula, programs, and university wide adoption. Moreover, metacognition becomes part of the normal language and practice for enhancing student learning within higher education. Improving understanding of metacognition will translate into greater implementation of metacognitive strategies in higher

education. The types of strategies used and the contextual and pedagogical considerations needed to impact meaningful and sustainable cultural change in higher education as a whole, but in athletic therapy education in particular, warrants further investigations. In doing so, targeted resources and support to help educators incorporate metacognitive strategies into their teaching practice can be examined. A major area for this improved understanding stems from professional pedagogical development training in metacognition (Ozturk, 2017; Zohar & Ben-Ari, 2022), in how to teach it and how to assess it to enhance student learning (Pintrich, 2002), subsequently enhancing metacognitive thinking skills of both students and educators.

An important step in developing supports for educators to improve their metacognitive awareness is to understand the barriers and facilitators to this. In chapter 6, the presentation of findings from the qualitative study investigating the barriers and facilitators to implementing metacognitive teaching strategies in allied healthcare education found that despite the known barriers, there was a strong desire by educators to overcome these barriers by upskilling in this area. Professional development courses were highlighted as ways to enhance educators' knowledge in this topic area, as they saw value in this, for aiding student learning. For the successful implementation of metacognition, the promotion of metacognition to all key contributors is needed, including faculty support in the development of metacognitive teaching strategies and the facilitation of greater student engagement and ownership of their learning. The results of this research show that although educators are willing to embrace metacognition because of its significance, they require training in this area. Therefore, metacognition should not be viewed as a skill to be taught to students, but rather a way of thinking (Wilson & Bai, 2010), that will continue with students into their career as an athletic therapist or allied healthcare professional. This will aid in their development of expertise and lifelong learning (Croskerry, 2018; Stanton et al., 2021; Tanner, 2012), a necessity for all

medical and healthcare professionals. To this end, in Chapter 7, the recommendations to facilitate the development of metacognition in athletic therapy education were devised. I recommended a 5E best practice conceptual framework for educators to successfully integrate metacognition into athletic therapy education: education, exposure & experience, encouragement of experimentation, enabling engagement, and explicit embedding. This may improve opportunities to foster metacognitive awareness, understanding, and implementation. The effectiveness of this will need to be assessed in future research.

The findings of this research noted in Chapters 4-6 consolidates the significant role metacognition plays in teaching and learning. Considering this and the impact this research has made on my professional practice as an educator, it has left me with a much greater appreciation and understanding of how students learn. It also has motivated me to continue to implement strategies to best support my students to become independent metacognitive thinkers through active collaborative tasks, encouraging them to think aloud and to reflect and ask why. Furthermore, it has allowed for metacognition to become part of the everyday language with my fellow educators and seeks ways as a faculty to enhance this for our athletic therapy students.

As a result of conducting this doctoral research and the findings achieved, it has without a doubt transformed my teaching practice. I am very cognisant of how students think and learn, use their metacognitive abilities and seek out ways to encourage them to regulate and reflect their cognitive processes. This is particularly evident in the modules that I teach, whereby I utilise a lot of active learning strategies, regularly ask students to self-reflect on their performance during a task and ask socratic questioning during clinical assessments and class time. As a result, I encourage students to think aloud through problem solving activities and role model my thinking in novel and complex clinical cases, emphasising the importance of

case pattern recognition of clinical cases, yet still, acknowledging that patients are complex and testing the hypothesis is necessary through various clinical tests. Continually asking what am I missing and self-reflecting on what went well, what didn't go well and where can I improve for the next time, so that my knowledge and practice continues to grow and develop.

8.3 Thesis limitations

The findings of this thesis must be interpreted with consideration to a number of limitations. Despite the global nature of athletic therapy and training profession worldwide, the practice and educational opportunities here in Ireland are currently limited, thus only small cohorts of athletic therapy students and educators participated in this research. As a result, the metacognitive awareness of both students and educators presented in chapters 4 and 5 may not be generalisable to other allied healthcare professionals and students worldwide. Social desirability/conformability bias and central tendency bias may have had an impact on the honesty and accuracy of responses. This may have been mitigated, to an extent, in Chapter 5 through the use of semi-structured interviews which provided an additional avenue for participants to provide their understanding and awareness of metacognition. Difficulties in measuring metacognition was another limitation identified which is common in this field, as metacognition is not directly observable (Craig et al., 2020). As a result, we used the originally devised metacognitive awareness inventory (Schraw & Dennison, 1994), that captured all eight theoretical components of metacognition (Harrison & Vallin, 2018). Although the convenience sampling of educators teaching on athletic therapy programmes in Ireland was small and limited, the results in chapters 5 and 6 were in line with previous research in this area (Dennis & Somerville, 2022; Zohar & Ben-Ari, 2022; Zohar & Lustov, 2018). In addition, during the semi-structured interviews, interviewer bias may have played a part, but this was mitigated

against by being open-minded and following the interview guide, allowing participants to willingly share their perceptions of metacognition without influence.

8.4 Future research

This research has investigated the influence of metacognitive awareness and understanding, primarily in students and educators for the enhancement of student learning and performance, in athletic therapy educational programmes in Ireland. Future research should evaluate the effectiveness and efficacy of the 5E conceptual framework to promote metacognitive awareness and facilitate the successful adoption of metacognition. Future research should also explore educators' perceptions of undertaking the professional training programme as presented in chapter 7. In addition, evaluating students' and educators' perspectives of the pedagogical and cultural changes in athletic therapy education, as a result of embedding metacognition within curricula, is also warranted. This research could then inform other allied healthcare educators and student cohorts on best practices when educating and implementing metacognitive teaching strategies within their undergraduate degrees. Moreover, the exploration of metacognitive awareness of athletic therapy students and educators internationally is needed to help establish international best practices for the profession that seeks to identify metacognition as a framework to guide all aspects of learning, not just clinical reasoning.

8.5 Thesis conclusion

The overarching aim of this research was to examine the role of metacognition in athletic therapy education through undertaking novel, meaningful and pragmatic research to enhance student learning, performance and ultimately, clinical reasoning skills. It soon became apparent that both clinical reasoning and metacognition theoretical concepts are complex,

nuanced, multifactorial and difficult to evaluate due to their invisible nature. Despite this, the literature over the past five decades reveals metacognition as a framework to aid individual's thinking about their thinking, helping them become reflective, self-regulated, independent, lifelong learners. Through quantitative, qualitative and mixed-methods research undertaken as part of this thesis, the findings have contributed to the existing literature by supporting the need to promote metacognition within higher education, to teach it explicitly to our students and educators and support the continued development of our educators in this field and ultimately, becoming metacognitive mentors and champions. The findings of this research have highlighted that athletic therapy students have moderately good metacognitive awareness; however, the enhancement of this critical higher order cognitive skill is needed. This can be achieved by enhancing educators' metacognitive awareness and implementation of metacognitive teaching strategies into their practice to aid student learning, by the facilitation of professional educational training in metacognition. We have also provided practical recommendations to embed metacognition within modules, programmes, universities and athletic therapy accrediting bodies. This can be achieved through education, exposure and experience, by encouraging experimentation inside and outside the classroom, enabling engagement through the explicit embedment of metacognition for meaningful and sustainable teaching and learning practices within higher education in Ireland, and in particular athletic therapy education.

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Appendices

Appendix 1 - Promoting Metacognitive Strategies to aid Clinical Reasoning Skills: A Case Study in Athletic Therapy/Training.

Allen L, O Connor S, Geisler P.R, Whyte E (2025). Promoting Metacognitive Strategies to aid Clinical Reasoning Skills: A Case Study in Athletic Therapy/Training. *Health Professions Educator Journal*. 2025;8(1). doi:10.53708/hpej.v8i1.2990

Abstract

Introduction: Clinical reasoning is the cornerstone of all healthcare professional practice and involves complex cognitive processes that facilitate how clinicians' reason and make decisions. Athletic Therapy/Training requires clinicians to make clinical decisions encompassing examination and diagnosis, therapeutic interventions, rehabilitation, emergency care and prevention of injuries and medical conditions. Effective clinical reasoning requires several cognitive processes and strategies, of which metacognition plays an essential role. Metacognition is viewed as thinking about thinking, the higher order cognitive processes that allow learners to regulate, reflect and evaluate knowledge and learning, identify gaps, and take remedial action needed to address this, ultimately assisting and enhancing their clinical practice.

Objectives: To examine the role of metacognition in enhancing clinical reasoning in the healthcare profession of Athletic Therapy/Training.

Results: We propose practical ways in which educators can employ metacognitive strategies to augment clinical reasoning educational practice and better promote learning and the development of clinical expertise.

Conclusions: Metacognition is at the heart of deep, lasting and meaningful teaching and learning practice. The explicit teaching of metacognitive strategies will enhance clinical

reasoning, formal education, and lifelong learning for healthcare professions such as Athletic Therapy/Athletic Training, and should be overtly integrated into current curricula.

Key Words: Clinical Reasoning, Metacognition, Higher Education, Reflective Practice, Clinical Expertise.

Introduction:

"When we reflect upon an experience instead of just having it, we inevitably distinguish between our own attitude and the objects toward which we sustain the attitude. Such reflection upon experience distinguishes what we experience (the experienced) and the experiencing—the how" (Dewey, 1916 p.173).

In athletic therapy/training clinical practice and education, reflecting upon our past experiences (both good and bad), both internally and externally (with peers and mentors) is an iterative process that helps us make sense of our professional success and failures. In clinical practice and education, athletic therapists must not only demonstrate, sharpen and refine many psychomotor competencies involved in caring for patients, but they must also develop and advance their cognitive skills and processes to enhance clinical reasoning and decision-making. These cognitive abilities are central to how we *think about our thinking* (Rivas et al., 2022) and how we *think about our learning*, namely metacognition, making it foundational for effective clinical reasoning to occur in athletic therapy/training and other health care professions. A core responsibility for educators should be the explicit teaching of how to "use, apply, modify and analyse" knowledge and skills that are dynamic and contextually relevant (Geisler & Lazenby, 2009 p.54). Similarly, Ward & Diug (2022) stated that the clinical learning environment should be one that is dynamic and varied, where learning is multi-layered, as evident in metacognition

Background to Metacognition

Metacognition, in its simplest term, is “thinking about thinking” (Flavell, 1979). It is the ability to regulate, reflect, evaluate, and control one’s thinking and learning (Schraw & Dennison, 1994). Metacognition is a conscious higher-order thinking activity that allows us to reflect back on what and how we learn and to promote active self-regulatory control of our learning, (Rivas et al., 2022) enabling deep, meaningful, and impactful application of knowledge and skills (Collins, et al., 2016; Welch et al., 2018). Metacognition requires problem-solving (Collins et al., 2016) and the ability to monitor and apply appropriate skills and strategies, to achieve a desired outcome (Medina et al., 2017). This ability to reflect, evaluate, identify learning deficits and make cognitive adjustments enables learners to become more cognitively aware (O’Loughlin & Griffith, 2020; Stanton et al., 2021). Metacognition guides learning strategies and allows a focus on acquiring knowledge that is missing or lacking, in order for further future learning to occur (Medina et al., 2017). This facilitates more meaningful and deeper learning in comparison to rote learning, memorization and surface learning (Joshi et al., 2022; O’Loughlin & Griffith, 2020).

Metacognition allows learners to develop their thinking to be more expert-like, where learning becomes more effective and efficient (Stanton et al., 2021). Metacognition gradually evolves as a multidimensional competence overtime through explicit instruction (Zohar & Barzilai, 2013). Becoming more aware of our thinking and abilities to reflect, monitor and control our thinking processes helps frame metacognition as a construct not only necessary for academic achievement, but also in clinical work settings and lifelong learning (Kuhn, 2000). In a clinical context, this ability to use knowledge improves thinking, and the “ability to step

back and reflect on what is going on in a clinical situation", preventing a critical error from occurring is the central principle of clinical reasoning (Croskerry, 2009; Magno, 2010).

Metacognition consists of two primary components a) knowledge of cognition and b) regulation of cognition (Schraw & Moshman, 1995). Knowledge of cognition (KC) refers to what individuals know about their thinking, how we learn, our ability to learn and the effectiveness and efficacy of our learning (Rivers et al., 2020; Schraw, 1998). It is the reflective aspect of learning. Regulation of cognition is the ability to control and manage learning and decision making, through monitoring and evaluation. It is viewed as the regulatory control of learning and involves the actions we take (Stanton et al., 2021; Welch et al., 2018). Both components of metacognition knowledge of cognition and regulation of cognition are interrelated (Schraw, 1998), and can enhance or limit learning depending on the ability and quality of learner's knowledge and regulatory control processes (Rivers et al., 2020). They span across many subject domains, enhancing the generalisability and applicability, ultimately improving expertise in a domain area (Fleur et al., 2021; Schraw, 1998), and in this case, clinical reasoning in athletic therapy and other healthcare professions. Therefore, the reflective aspect of learning and regulatory cognitive processes to learn are central to clinical reasoning and thus to the development of the cognitive attributes of clinical expertise (Medina et al., 2017).

Knowledge of cognition consists of three subcomponents: declarative knowledge, procedural knowledge, and conditional knowledge (Schraw & Moshman, 1995). Declarative knowledge is knowing information and facts; the "what" of knowledge. Procedural knowledge represents the "how" of knowledge and performing it as a skill or a behaviour. Conditional knowledge signifies knowing "when and why" to use a particular skill (Kosior et al., 2019; Welch et al., 2018), as shown in Table A1.

Regulation of cognition is broken down into 5 subcomponents which includes planning, information management strategies, monitoring, debugging strategy and evaluation of learning (Table A1), (Schraw, 1998; Schraw & Moshman, 1995). Planning involves choosing the best strategy and allocation of cognitive resources that will affect performance and achieve the desired outcome. This may involve deliberate study methods, ordering of thoughts and goal setting (Kosior et al., 2019; Versteeg et al., 2021). Information management strategies are actively reflecting on whether enough information was gathered, which is a crucial element in minimising errors. Monitoring encompasses an awareness of cognitive performance through the ability to establish if progress is being made in a clinical scenario. This is evident in the learner's ability to utilise the clinical information and check to see if clinical progress is occurring during a treatment technique. Debugging strategies refers to intentionally looking for discrepancies and errors. This requires the learner to formulate differential diagnoses as part of the diagnostic reasoning challenge. Lastly, the evaluation of learning refers to the ability to appraise and assess if progress has been made in solving a clinical problem (Kosior et al., 2019; Welch et al., 2018).

Table A1.1: Components of metacognition

The Components of Metacognition			
Primary component	Sub component	Meaning	Practical Application
Knowledge of cognition	Declarative knowledge	Knowing information and facts; the "what" of knowledge	Learners acquire and learn knowledge pertaining to epidemiology, aetiology, pathophysiology, clinical presentation, differential diagnosis, treatment and management of Anterior Cruciate Ligament (ACL) injuries.
	Procedural knowledge	The "how" of knowledge and performing it as a skill or a behaviour	Learners use their procedural knowledge in how to perform a Lachman's test and anterior drawer test for ACL integrity, pain and laxity or how to develop a rehabilitation program.
	Conditional knowledge	Knowing "when and why" to use a particular skill	Learners knowing when and why to perform these tests, based on relevant subjective and objective questioning and the context of the situation.

Regulation of cognition	Planning	Choosing the best strategy and allocation of cognitive resources that will effect performance and achieve the desired outcome	Learner evaluates all the pertinent findings from the subjective and objective clinical assessment and outlines a suitable ACL treatment and rehabilitation goals with the patient.
	Information management strategies	Actively reflecting on whether enough information was gathered	Learner actively reflecting on the information gathered from the clinical assessment as to whether it was sufficient in accurately diagnosing and treating the patient's injury as an ACL rupture. If insufficient information is obtained, the learner/ clinician may develop a strategy to obtain the extra information.

	Monitoring	Awareness of cognitive performance, through the ability to self-test and establish if progress is being made	Rehabilitation exercises are given to the patient and outcome measures are monitored such as measuring quadriceps strength using a dynamometer.
	Debugging strategy	Intentionally looking for discrepancies and errors	The ability of the learner to ask is there another diagnosis I'm missing, What other assessments could I perform to accurately diagnose and treat the patient?
	Evaluation	The ability to appraise and globally assess if progress has been made	The ability to re-assess a patient's treatment goals and outcomes measures weekly, ACL return to play protocol is being made in a timely manner.

Metacognition provides a framework to identify what we do know and do not know. This helps us better prepare for future patient encounters and learning, through the careful reflection and evaluation of all forms of evidence from our past experiences and learning, both internally and externally (McKeon & McKeon, 2020). The inter-connectedness of both knowledge of cognition and regulation of is evident when we use metacognitive control of learning to enhance the integration of clinical and basic science in the form of declarative knowledge, enabling more effective diagnostic reasoning. This reasoning can be subject to metacognitive monitoring, as diagnostic reasoning can reveal gaps in the learner's knowledge where future learning, planning and goal setting can remediate these gaps, enabling the learners to exercise more regulatory control of their learning.

Metacognition and Learning

A primary aim of all educators is to facilitate *"learning to learn"* in our classrooms and teaching facilities, where learners develop cognitive learning strategies to aid their self-directed, autonomous learning through the promotion and development of metacognition (Rivas et al., 2022). To do this, educators need to "*teach how to learn"* and "*teach how to think"* for successful learning to occur, as the majority of learning takes place outside of the classroom (Dennis & Somerville, 2022). This facilitation of metacognition and thinking skills is very transferrable to clinical reasoning (Rivas et al., 2022). Learning is an active and dynamic process that requires learners to think about their thinking, to be metacognitively aware (Wilson & Bai, 2010). Metacognition provides educators and learners with learning strategies to assess, monitor, evaluate, plan, and reflect on their knowledge. Despite the supporting evidence from the literature that metacognition is the hierarchical cognitive processes at play during clinical reasoning (Geisler et al., 2014; Geisler, 2022), very limited research exists to promote and emphasise the importance of metacognition in athletic therapy.

Learners may not typically utilize the most effective learning strategies, resulting in poor metacognitive awareness (McCabe, 2011). Poor metacognitive awareness can result in ineffective study strategies, impacting academic performance, and excessively high rates of bias (Medina et al., 2017). Students and clinicians need to monitor their metacognition through active cognitive processing, reflection and evaluation (Kosior et al., 2019). When learners and novices plan, monitor and regulate their cognitive processes, their metacognitive strategies develop more in line with such cognitive traits of experts (Magno, 2010; Siqueira et al., 2020), resulting in more effective and efficient approaches to learning (Kosior et al., 2019; Siqueira et al., 2020), and resulting in improved clinical reasoning and in turn, better patient care. This ongoing and reiterative process emphasizes the need for learners to be taught specific metacognitive strategies as part of their educational pathway, which will then directly influence their clinical practice, lifelong learning, and, ultimately, their patient care.

To overcome this, deconstructing the metacognitive components involved in clinical reasoning may enable learners to better understand the content and its application to clinical reasoning (Kosior et al., 2019). This may occur by explicitly structuring and guiding learners' thinking and reasoning. Educators need to help learners become more metacognitively aware by identifying what they do and don't know and explicitly teaching metacognitive strategies to improve this (Versteeg et al., 2021). Educators need to integrate metacognition into an everyday part of the classroom by using this terminology and language. Fostering learner's ability to discuss their cognition and learning through the use of novel assessment strategies that provide tools to scaffold learning, metacognitive habits, and lifelong learning is also necessary (Cutrer et al., 2021; Versteeg et al., 2021). However, it first requires educators to be metacognitively aware.

Metacognitive Teaching Strategies

Clinical reasoning is best developed by teaching strategies that increase and assess knowledge and competence through experiential learning, intentional deliberate practice with real patients and critical feedback and reflection, of which metacognition encompasses (Khin-Htun & Kushairi, 2019). More importantly, metacognitive strategies have been used as a part of an error detection and recovery framework, in an attempt to minimise medical errors from occurring. This allows the identification and correction of knowledge and skills of a clinical problem, which in turn results in remedial measures occurring, without compromising patient safety (Mamede & Schmidt, 2022; Patel et al., 2015). The development of clinical reasoning not only relies on acquiring knowledge, but, importantly, the organization and structuring of this knowledge to make it accessible and applicable to all learners (Linsen et al., 2018), for which this is the fundamental and practical application of metacognition. The awareness of one's own cognitive processes remains a very challenging skill to teach healthcare professional learners, as part of clinical reasoning education (Kosior et al., 2019). Metacognitive awareness skills are essential to enhance the development of clinical reasoning expertise (Kicklighter et al., 2016), especially after the formal education experience ceases and graduates become autonomous practitioners.

There are many different ways in which athletic therapy educators can implement metacognitive strategies in the classroom, such as active learning strategies, deliberate practice and feedback, and reflective practice, where their effect can cross all components of metacognition. Promoting both knowledge and regulation of cognition of metacognition forms the basis of clinical reasoning pedagogy (Kosior et al., 2019). Clinical reasoning is improved through educational interventions such as metacognitive strategies (Gruppen, 2017), that deliberately scaffolds pedagogical teaching practice, allowing learners to engage in their

knowledge and regulation of their cognition (Kosior et al., 2019; Tanner, 2012). The metacognitive teaching strategies examined in this paper were mapped to correspond with each of the eight subcomponents of metacognition, to aid educator's ability to use these in their athletic therapy classroom. Some of these strategies may be effective across multiple subcomponents of metacognition.

Teaching strategies to aid metacognitive knowledge of cognition

Knowledge of cognition has three metacognitive subcomponents, namely, declarative, procedural and conditional. Declarative knowledge pertains to what knowledge a learner has acquired. Active learning methods such as SNAPPS (summarise, narrow, analyse, probe, plan and select), can be used to enhance declarative knowledge. This encourages learners to think clearly, and consider their thought processes more systematically, for example, by analysing their differential diagnoses to resolve the case. Heinrichs and colleagues found that an active learning strategy such as SNAPPS improved clinical reasoning, as evidenced in their ability to better summarise case key findings better than the control group (Heinrichs et al., 2013), thus enhancing their declarative knowledge. Active learning strategies can also be implemented in group/collaborative work to enhance declarative knowledge. For example, the Student Generated Reasoning Tool is a resource that asks learners to propose and justify clinical hypotheses, and findings and critically appraise the information related to the clinical problem (Zagury-Orly et al., 2022). This tool is used for case based collaborative learning, where learners justify their clinical reasoning. This justification of reasoning, allows learners to be made aware of their knowledge and to generate the "why" and "how" questions, promoting higher order thinking and deep learning to occur (Zagury-Orly et al., 2022).

Deliberate practice and feedback can enhance procedural knowledge, as it allows learners to develop strategies that seek out how a skill is performed. Debriefing after simulations and clinical patients' experiences are practical ways for educators to enhance feedback to learners. It allows learner's time to reflect and learn from the experience, developing critical appraisal of their knowledge base and skills that may need further refining and development (Edler et al., 2019). Educators should encourage learners to practice deliberately and request feedback on their performance to enhance and maximise learning (Newsom et al., 2022). The role of the educator/preceptor is critical in providing this feedback to improve this procedural knowledge.

Conditional knowledge allows learners to know "when and why" to use particular knowledge and skills, thus developing clinical context skills in learners (Teunissen et al., 2021). This can be developed using role modelling and simulation by exposing learners to different clinical cases, encouraging them to look at different contexts and the "bigger picture" of a clinical encounter (Khin-Htun & Kushairi, 2019). Learners do not operate in a vacuum but rather in real-world complex clinical practice, where context specificity is important (Eva, 2005; Koufidis et al., 2022; Ward & Diug, 2022), and should be consciously considered and cultivated by educators and preceptors (Joshi et al., 2022). Simulation allows learners to deliberately practice their clinical reasoning, reflection, and domain-specific skills (Kosior et al., 2019). Augmented reality is an emerging simulation technology with the potential to further advance simulation education (Kassutto et al., 2021).

Table A1.2 Strategies to aid Teaching Metacognition

Strategies to aid Teaching Metacognition			
Components of Metacognition		*Selected Teaching Strategy*	
Knowledge of cognition	Declarative knowledge: "What of knowledge"	SNAPPS	(Summarise, narrow, analyse, probe, plan and select), allows learners to think clearly, considering their thought processes more systematically and analysing their differential diagnoses to resolve the case.
		Student Generated Reasoning Tool	Allows learners to propose and justify clinical hypotheses, findings and critically appraisal the information related to the clinical problem.
	Procedural Knowledge: "How of knowledge"	Deliberate Practice and feedback	Allows learners to deliberately practice their clinical reasoning skills and receive feedback from educators on their performance.

	Conditional Knowledge: "When and Why of knowledge"	Role Modelling and Simulation (Debriefing)	Exposes learners to different clinical cases, encouraging them to look at different contexts and the “bigger picture” of a clinical encounter.
Regulation of Cognition	Planning	Team Based Learning	Provides learners with an opportunity to complete individual and team based readiness assessment tests, to evaluate, plan, reflect and adjust their learning as needed.
	Information Management Strategies (organising)	Concept Mapping	Allows learners to graphical representation knowledge and content of topic, through the mental connections and associations of the learners knowledge which is typically displayed on a flipchart or can also be presented digitally.
	Monitoring (Control)	Think-aloud	Promotes conscious monitoring and evaluation by the learner in groups or individualised.

	Debugging Strategies (Troubleshooting)	Self Questioning	Provides learners with simple direct questions on their performance such as: What went well in the clinical encounter? What didn't go well? Describe other ways you could have done that? What made you choose that way? What other options could you have chosen and why?
		Muddiest Point	Allows learners to self question "what was the most confusing content explored in class today?"
	Evaluation (consider the results)	Reflection	Deliberate reflection allows learners to an opportunity to reflect and focus on the learning process. Flipgrid's and online blogs are viewed as useful tools for reflective thinking and practice.

Teaching strategies to aid metacognitive regulation of cognition

An essential component of regulation of cognition is planning, which demands substantial reflective evaluation to know where one needs to improve one's performance (Rivas et al., 2022). An example of how this can be developed is by using team-based learning. It is an active teaching pedagogy that provides learners with an opportunity to scaffold their knowledge, through multiple assessments and feedback (Martirosov & Moser, 2021). Team-based learning requires learners to complete individual and team-based readiness assessment tests, which provide both learners and educators with feedback on content knowledge and skills through a cooperative and collaborative learning format. Engagement with these assessments develops learners' metacognitive skills in evaluation, planning, reflection, and adjustment of their learning as needed.

Information management strategies are central to the ability to regulate cognition. It seeks to organize learner's information and establish if enough information is gathered. The development of information management strategies can be developed using problem-based learning which is a teaching approach where learners work independently or in small groups to gain knowledge and learn, by solving problems (Gholami et al., 2016; Gillette, 2017). Problem based learning encourages learners in autonomous and active participatory learning, where clinical cases are investigated, interpreted, reasoned and resolved. The use of concept mapping is another method to enhance active metacognitive learning strategies through a graphical representation of the learner's knowledge and the content of the topic (Joshi et al., 2022). The diagrams present the mental connections and associations of the learner's knowledge which is typically displayed on a flipchart or can also be presented digitally. Joshi and colleagues found concept mapping a helpful tool in knowledge synthesis and information

management, as evidenced by learner's ability to recontextualise information (Joshi et al., 2022).

Active monitoring of knowledge is a necessary component in the regulation of cognition, whereby establishing an awareness of cognitive performance is needed. Think aloud strategies are popular ways to provide an insight into a learners metacognitive monitoring. Think aloud protocols allows learners to verbalise their thought processes, during their clinical encounter (Jordano & Touron, 2018). This can provide the educator and the learner with rich and detailed information about their cognitive monitoring and control. It also allows for feedback from the educator to further enhance this learning.

Debugging strategies allow for learners to intentionally look for discrepancies and errors, which is of significant importance in the regulation of cognition, to minimize medical errors. Self-questioning practice and educator feedback to learners, provide educators with a simple way to embed debugging strategies into their teaching practice. Educators can promote metacognitive awareness through posing questions to learners that promote higher order thinking (Tanner, 2012). This can be achieved through questioning to challenge deeper thoughts and connections around a topic, by simply asking learners "why". Asking "why" is an especially effective questioning strategy when addressing a student learner or novice clinician's reasoning skills. This approach directly promotes and assesses knowledge synthesis and higher-order thinking (Bordage & Lemieux, 1991; Gonzalez et al., 2021). These questions can be embedded into teaching assessments such as assignments, exams or used formatively within the classroom (Medina et al., 2017; Tanner, 2012). Reflective questions stimulate thought and reflection by the learners and can include simple direct questions on their performance such as: *What went well in the clinical encounter? What didn't go well? Describe*

other ways you could have done that? What made you choose that way? What other options could you have chosen and why? Educators must be intentional about structuring learning experiences for their learners, by asking reflective questions that will shape their clinical reasoning (McDevitt et al., 2019). The muddiest point is a simple in-class assessment used by educators to establish any challenging concepts or content for learners (Tanner, 2012). It is usually completed at the end of class for 1-5 minutes where a question is addressed to the class, such as *What was the most confusing content explored in class?* This allows both educators and learners to reflect, evaluate and plan for the next teaching session, seeking to remediate these knowledge and practice gaps.

The development of evaluation of learning is embedded in reflective practice, where fostering learners' reflective capacities is necessary for the development of metacognition and ultimately clinical reasoning (Gilliland & Wainwright, 2017; Menezes et al., 2015), alongside better professional practice (Préfontaine et al., 2021). A common way of facilitating evaluation of learning is through written reflection such as journal writing and blogs (O'Loughlin & Griffith, 2020; Wilford & Morretta, 2022). Strategies that employ structured and guided reflection are useful tools to aid metacognition and clinical teaching methods (Lambe et al., 2016; Mamede et al., 2014; Prakash et al., 2019). Self-reflective activities that included non-written group discussions and written reflections were positively perceived by learners in developing clinical reasoning, requiring minimal additional time by educators (Wilford & Morretta, 2022). Reflective note writing was highlighted by Agarwal and Rawekar as beneficial in consolidating learning from clinical exposure, invoking critical thought and analysis and promoting professionalism (Agarwal & Rawekar, 2020) and increasing self-confidence in their abilities (O'Loughlin & Griffith, 2020; Tanner, 2012). The use of reflection through technology enhanced learning modes such as Flipgrid's and online blogs are viewed

as useful tools for reflective thinking and practice (Stoszkowski et al., 2020; Stoszkowski & Collins, 2017). Reflecting on errors made demonstrates value, meaning, and context, facilitating deep and meaningful learning, all of which enhances clinical reasoning and minimizes medical errors.

Conclusion

The development of higher-order cognitive skills such as metacognition is needed for self-directed, lifelong learning skills, which are deemed critical for a career as an athletic therapist and other healthcare professions. If educators expect future clinicians to display these critical professional attributes of competence and eventual expertise, they must be explicitly taught, promoted and assessed during didactic and experiential learning experiences, as it is not a guarantee that they will develop autonomously in all students. This development of thinking and learning skills as outlined by Higgs and colleagues, should be a priority for healthcare professionals including athletic therapists as it contributes to clinical reasoning capability, adaptive expertise, and the ability to reason well in future clinical situations where the situation is novel, or the context unfamiliar and complex (Higgs et al., 2018).

Recommendations:

Metacognition is an essential element of clinical reasoning. Despite its importance being recognized, there is a lack of clarity on how to translate this skillset to our learners (Welch et al., 2018). Greater emphasis must be placed on the explicit teaching and assessment of metacognitive strategies in athletic therapy and healthcare professional education, whereby educators are acquainted with the most current practical applications of this method, thus increasing overall clinical reasoning skills. Clinical reasoning represents the interconnected roles of learning and experience as aptly defined as “thinking drives doing and doing can only

be improved and progressed by thinking," (Geisler & Lazenby, 2009 p.54) which in essence, *is* metacognition. Metacognition is at the heart of teaching and learning, where it is a continual cycle which learners, educators, and clinicians alike reflect on their decision-making and thought processes using metacognitive strategies in order to remediate and enhance future learning (Rivas et al., 2022). As much learning takes place outside of the classroom (Rivers et al., 2020). Therefore, the need to equip our students with direct, effective, and efficient metacognitive strategies is paramount for any health profession educator. Although the literature supports the use of metacognitive teaching strategies in the classroom to aid learning and, ultimately, clinical reasoning, currently the recognition of its importance is not reflected in AT educators' practice or through its embedment into curricula. Thus, the explicit use of simple metacognitive strategies and reflective practice as central tenets of AT curriculum can help foster the development of competent clinical reasoning skills and, in time, clinical expertise.

Appendix 2 - Cover Letter for Research Study

Dear Programme Chair,

The School of Health and Human Performance in Dublin City University (DCU) is currently performing a national research project to investigate the metacognitive awareness among Irish undergraduate Athletic Therapy students.

We would be extremely grateful if you could circulate this email or the questionnaire itself to your healthcare students.

The research involves completing an online anonymous questionnaire that will take approximately 15 minutes to complete. The link for the questionnaire is below.

Metacognitive Awareness among Irish Athletic Therapy Students - Google Forms

The Plain Language Statement is included at the beginning of the questionnaire and outlines the purpose of the research project, the benefits and risks to participants, and the confidentiality agreement.

Please take some time to read this before deciding if you would like to complete the questionnaire.

Kind regards,

Lynn Allen (MSc, PGDip, CAT)

Research Team: Ms. Lynn Allen (Professional Doctorate Student in School of Health and Human Performance, Dublin City University; Lecturer in Athletic and Rehabilitation Therapy, Department of Sport and Health Science, Technological University of the Shannon, Midlands Midwest; Certified Athletic Therapist)

Dr. Siobhan O'Connor (Associate Professor in Athletic Therapy and Training, School of Health and Human Performance, Dublin City University; Certified Athletic Therapist)

Dr. Enda Whyte (Assistant Professor in Athletic Therapy and Training, School of Health and Human Performance, Dublin City University; Certified Athletic Therapist, Chartered Physiotherapist).

Contact information: Lynn Allen Email: lynn.allen22@mail.dcu.ie

Appendix 3 - Plain Language Statement

DUBLIN CITY UNIVERSITY

Research Pilot Study: Metacognitive Awareness Among Irish Athletic Therapy Students

Principal Investigator: Ms. Lynn Allen

Contact details: lynn.allen22@mail.dcu.ie

Other Investigators: Dr. Siobhán O'Connor, Dr. Enda Whyte

School of Health Human Performance, Dublin City University.

Introduction to the Research:
Athletic Therapy/Training is an allied healthcare profession specialising in the prevention, assessment, diagnosis, treatment and rehabilitation of injuries occurring during physical activity, sporting and occupational activities. This anonymous online survey is designed to establish metacognitive awareness among Irish undergraduate Athletic Therapy students and the factors that affect it, as well as the past learning experiences and current learning practices.

This research is part of a larger project aimed at promoting and improving metacognitive teaching practices in medical and allied healthcare professional education, nationally and internationally.

What this research study involves:

To take part you must be an undergraduate athletic therapy student attending an ARTI accredited undergraduate degree in athletic therapy, in Ireland. You will be asked to complete an anonymous survey that will take approx. 15 minutes. The anonymous online questionnaire will examine your metacognitive awareness by completing a 52-item questionnaire on your cognitive knowledge and regulation.

Potential benefits to participants:

While the direct benefits for your participation in this research study are limited, the survey may facilitate you to reflect on your current, past and future learning and cognitive processing. In addition, information gathered in this study may form the basis for the development of teaching practices in Athletic Therapy and the wider medical and allied healthcare education.

Potential risks to participants:

There are no serious potential risks for you, however, following completion of the survey, if you have any concerns or negative thoughts regarding your cognitive/learning experiences, you should arrange an appointment with your General Practitioner (GP) to discuss these concerns.

Privacy Notice:

The anonymous data collected will be used to create a data set as a reference for the metacognitive awareness of Irish undergraduate Athletic therapy students in Ireland. Summated data, with no identifiable information may be published in peer-reviewed journals and presented at conferences. DCU will be the Data Controller in this project.

Data Retention:

You will anonymously complete an online survey that will not request any identifying personal information including your name, date of birth or any contact details. All data will be stored and handled in compliance with GDPR guidelines in a password protected file on the DCU Google Drive. Data will be stored indefinitely for publication purposes. The answers you provide will be analysed by Ms Lynn Allen, the primary investigator of this research.

Protection of confidentiality of data:

Confidentiality and anonymity are of utmost importance in this study. All data will be stored in a password protected file on DCU Google Drive. Confidentiality of information can only be protected within the limitations of the law - i.e., it is possible for data to be subject to subpoena, freedom of information claim or mandated reporting by some professions.

Voluntariness of this Study:

Involvement within this research is purely voluntary. You have the right to withdraw from this study at any point, prior to the completion of the survey without penalty or explanation. As all collected data will be anonymous, once you have participated in the research, your data cannot be identified and withdrawal cannot be facilitated at this point. Your involvement/non-involvement in this research project will in no way affect any on-going relationship with Dublin City University.

If participants have concerns about this study and wish to contact an independent person,

please contact:

The Secretary, Dublin City University Research Ethics Committee, c/o Research and Innovation Support, Dublin City University, Dublin 9. Tel 01-7008000, e-mail rec@dcu.ie

Appendix 4- Consent Form

Research Study: "Metacognitive awareness among Irish Athletic Therapy Students"

Principal Investigator: Ms. Lynn Allen

Contact details: lynn.allen22@mail.dcu.ie

Other Investigators: Dr. Siobhán O'Connor, Dr. Enda Whyte

School of Health Human Performance, Dublin City University.

The aim of this study is to examine undergraduate athletic therapy student's metacognitive awareness.

Consent section

I have read the Plain Language Statement (or had it read to me) *

- o Yes
- o No

I understand the information provided *

- o Yes
- o No

I have had an opportunity to ask questions and discuss this study *

- o Yes
- o No

I have received satisfactory answers to all of my questions

- o Yes
- o No

I understand the information provided in relation to data protection *

- o Yes

- o No

I understand I may withdraw from this research study at any point *

- o Yes
- o No

I have read and understand the arrangements to be made to protect confidentiality of data, including that confidentiality of information provided is subject to legal limitations *

- o Yes
- o No

I have read and understand confirmations relating to any other relevant information as indicated in the PLS *

- o Yes
- o No

I consent to participate in this study *

- o Yes
- o No

The survey will end if the participant chooses a 'No' option in any of the questions.

Appendix 5 - Metacognitive Awareness Inventory Questionnaire

DUBLIN CITY UNIVERSITY

Section 1: Demographic Questions

Q1. Are you 18 years or older?

- o Yes
- o No

Q2. What is your gender?

- o Man
- o Woman
- o Non-binary
- o Prefer not to say
- o Other: _____

Q3. Are you an undergraduate student?

- o Yes
- o No

Q4: Are you currently studying in Ireland?

- o Yes
- o No

If No, can you provide the country where you are studying?
_____

Q5. Are you an Athletic Therapy student?

- o Yes
- o No

Q6: Have you completed any prior education?

- o Yes
- o No

If yes: Please tick all appropriate to your educational history

- o Leaving Certificate
- o National Framework of Qualifications level 6
- o National Framework of Qualifications level 7
- o National Framework of Qualifications level 8

Q7. What year of study are you currently in:

- o Year 1
- o Year 2
- o Year 3
- o Year 4

Q8: Are you a mature student (aged 23 years and above on year of entry to program)?

- o Yes
- o No

Q9: Have you completed a clinical immersive placement?

- o Yes
- o No

If yes, can you provide the country in which your clinical immersive placement took place and how hours were undertaken _____

Q10: What setting did your immersive placement experience occur in: Please tick all appropriate to your experience

- o Clinical
- o Pitch-side
- o Hospital
- o Sporting Organisations
- o Occupational
- o Military

Q11 : Have you completed placement experience linked to a module you are currently studying in your Athletic Therapy programme?

- Yes
- No

If yes, can you provide the year(s) of study this placement took place and how hours were undertaken _____

Section 2: Metacognitive Awareness Inventory

Read the following statements carefully.

Consider if the statements are true or false as it generally applies to you as a student/ learner.

Use X True or False as appropriate for each statement.

	Metacognitive Awareness Inventory		
		True	False
Q1:	I ask myself periodically if I am meeting my goals.		
Q2:	I consider several alternatives to a problem before I answer.		
Q3:	I try to use strategies that have worked in the past.		
Q4:	I pace myself while learning in order to have enough time.		
Q5:	I understand my intellectual strengths and weaknesses.		
Q6:	I think about what I really need to learn before I begin a task		
Q7:	I know how well I did once I finish a test.		
Q8	I set specific goals before I begin a task.		
Q9:	I slow down when I encounter important information.		
Q10:	I know what kind of information is most important to learn.		
Q11:	I ask myself if I have considered all options when solving a problem.		
Q12:	I am good at organizing information.		
Q13:	I consciously focus my attention on important information.		

Q14:	I have a specific purpose for each strategy I use.		
Q15:	I learn best when I know something about the topic		
Q16:	I know what the teacher expects me to learn		
Q17:	I am good at remembering information.		
Q18:	I use different learning strategies depending on the situation.		
Q19:	I ask myself if there was an easier way to do things after I finish a task.		
Q20:	I have control over how well I learn.		
Q21:	I periodically review to help me understand important relationships.		
Q22:	I ask myself questions about the material before I begin.		
Q23:	I think of several ways to solve a problem and choose the best one.		
Q24:	I summarise what I've learned after I finish.		
Q25:	I ask others for help when I don't understand something.		
Q26:	I can motivate myself to learn when I need to		
Q27:	I am aware of what strategies I use when I study.		
Q28:	I find myself analysing the usefulness of strategies while I study.		
Q29:	I use my intellectual strengths to compensate for my weaknesses.		
Q30:	I focus on the meaning and significance of new information.		
Q31:	I create my own examples to make information more meaningful.		
Q32:	I am a good judge of how well I understand something.		
Q33:	I find myself using helpful learning strategies automatically.		
Q34:	I find myself pausing regularly to check my comprehension.		
Q35:	I know when each strategy I use will be most effective.		
Q36:	I ask myself how well I accomplish my goals once I'm finished.		
Q37:	I draw pictures or diagrams to help me understand while learning.		

Q38:	I ask myself if I have considered all options after I solve a problem.		
Q39:	I try to translate new information into my own words.		
Q40:	I change strategies when I fail to understand.		
Q41:	I use the organisational structure of the text to help me learn.		
Q42:	I read instructions carefully before I begin a task.		
Q43:	I ask myself if what I'm reading is related to what I already know.		
Q44:	I re-evaluate my assumptions when I get confused.		
Q45:	I organise my time to best accomplish my goals.		
Q46:	I learn more when I am interested in the topic		
Q47:	I try to break studying down into smaller steps		
Q48:	I focus on overall meaning rather than specifics.		
Q49:	I ask myself questions about how well I am doing while I am learning		
Q50:	I ask myself if I learned as much as I could have once I finish a task.		
Q51:	I stop and go back over new information that is not clear		
Q52:	I stop and reread when I get confused		

Appendix 6 - Plain Language Statement

Research Study: Irish Athletic Therapy Educators knowledge, understanding and implementation of metacognitive teaching strategies.

Principal Investigator: Ms. Lynn Allen

Contact details: lynn.allen22@mail.dcu.ie

Other Investigators: Dr. Siobhán O'Connor, Dr. Enda Whyte

siobhan.oconnor@dcu.ie, enda.whyte@dcu.ie

School of Health Human Performance, Dublin City University.

Introduction to the Research Study:
Athletic Therapy/Training is an allied healthcare profession specialising in the prevention, assessment, diagnosis, treatment and rehabilitation of musculoskeletal injuries associated with physical activity, inclusive of sporting elite athletes. This online survey and semi structured interviews are designed to examine Athletic Therapy educators in Ireland, their knowledge and understanding of metacognition and what the facilitators and barriers to implementing metacognitive teaching strategies are in Athletic Therapy education.

This research is part of a larger project aimed at promoting and improving metacognitive teaching practices in medical and allied healthcare professional education, nationally and internationally.

What this research study involves:

To take part you must be an Athletic Therapy educator in Ireland currently teaching students in an ARTI accredited third level institution namely, Dublin City University, Technological University of Shannon, Athlone, South East Technological University, Carlow, in Ireland. You will be asked to complete a questionnaire that will take approx. 15 minutes. The online questionnaire will examine your knowledge and understanding of metacognition and what the facilitators and barriers to implementing metacognitive teaching strategies are in Athletic Therapy education. At the conclusion of the questionnaire, you will be invited to take part in a subsequent semi structured interview taking approximately 45 minutes to complete on Zoom (Zoom Video Communications, Inc., San Jose, CA) should you wish to. If participants choose to take part in part 2 of the study (semi- structured interviews), they will be directed to follow the link at the end of the survey which will bring them to a google forms url that will only collect their email addresses should they wish to participate in the interview. The interview will

discuss in greater detail their knowledge, understanding and implementation of metacognition in your teaching practices.

Potential benefits to participants:

While the direct benefits for your participation in this research study are limited, the questionnaire and semi structured interviews may facilitate you to reflect on your current, past and future teaching and learning experiences. In addition, information gathered in this study may form the basis for the development of teaching practices in Athletic Therapy and the wider medical and allied healthcare education.

Potential risks to participants:

There are no serious potential risks for you.

Privacy Notice:

Semi-structured interview participants will receive an ID number and all data collected will be identified using that ID number only, no participant names will be used. Only audio recordings will be conducted and then stored on a password protected restricted access Google Drive, that only the named researchers will be able to access. Once the anonymous transcription of semi-structured interviews has taken place the audio recordings will be destroyed after two weeks. These recordings are kept for these two weeks in case clarification is required. The anonymous transcriptions of the semi-structured interviews will then be stored on a password protected restricted access Google Drive that only the named researchers will have access to. No hard copies of the transcriptions will exist. The data collected will be used to create a data set as a reference for the Irish Athletic Therapy Educators knowledge, understanding and implementation of metacognitive teaching strategies study.

Summated data, with no identifiable information may be published in peer-reviewed journals and presented at conferences. DCU will be the Data Controller in this project.

Data Retention:

All data will be stored and handled in compliance with GDPR guidelines in a password protected file on the DCU Google Drive. Data will be stored indefinitely for publication purposes.

The answers you provide will be analysed by Ms Lynn Allen, the primary investigator of this research.

Protection of confidentiality of data:

Confidentiality and anonymity are of utmost importance in this study. All data will be stored in a password protected file on DCU Google Drive. Confidentiality of information can only be protected within the limitations of the law - i.e., it is possible for data to be subject to subpoena, freedom of information claim or mandated reporting by some professions. Semi structured Interviews will be transcribed and anonymised, and audio recording files will then be deleted.

Anonymised transcripts (i.e. with no identifying information) will be stored securely indefinitely for publication purposes.

Voluntariness of this Study:

Involvement within this research is purely voluntary. You have the right to withdraw from this study at any point, prior to the completion of the survey without penalty or explanation. As the collected questionnaire data will be anonymised, once you have participated in the research, your data cannot be identified and withdrawal cannot be facilitated at this point.

During the semi structured interview, you may stop at any time without explaining why you do not wish to continue. You may also withdraw from the research project at any point prior to semi structured interview transcription is complete as at this point data will be anonymised and personal data cannot be identified from anonymous data. Your involvement/non-involvement in this research project will in no way affect any on-going relationship with Dublin City University.

If participants have concerns about this study and wish to contact an independent person,

please contact:

The Secretary, Dublin City University Research Ethics Committee, c/o Research and Innovation Support, Dublin City University, Dublin 9. Tel 01-7008000, e-mail rec@dcu.ie

Appendix 7 - Informed Consent Form

Research Study: "Irish Athletic Therapy Educators knowledge, understanding and implementation of metacognitive teaching strategies"

Principal Investigator: Ms. Lynn Allen

Contact details: lynn.allen22@mail.dcu.ie

Other Investigators: Dr. Siobhán O'Connor, Dr. Enda Whyte

School of Health Human Performance, Dublin City University.

The aim of this study is to examine Athletic Therapy educators in Ireland, your knowledge and understanding of metacognition and what the facilitators and barriers to implementing metacognitive teaching strategies are in Athletic Therapy education.

Consent section

I have read the Plain Language Statement (or had it read to me) *

- o Yes
- o No

I confirm that I am over the age of 18 years old

- o Yes
- o No

I understand the information provided *

- o Yes
- o No

I understand that in the case of any questions, I had an opportunity to contact the primary investigator on the email provided in the Plain Language Statement (PLS) and have received satisfactory answers to my questions if I contacted them *

- o Yes
- o No

I understand the information provided in relation to data protection *

- o Yes
- o No

I understand I may withdraw from this research study at any point *

- o Yes
- o No

I have read and understand the arrangements to be made to protect confidentiality of data, including that confidentiality of information provided is subject to legal limitations *

- o Yes
- o No

I have read and understand confirmations relating to any other relevant information as indicated in the PLS *

- o Yes
- o No

I consent to participate in this study *

- o Yes
- o No

Appendix 8: Allied healthcare educators' awareness, understanding, and implementation of metacognitive teaching strategies within their practice: Questionnaire.

Section 1: Demographic Questions

Q1. What is your age (in years)?

_____

Q2. What is your gender?

- o Man
- o Woman
- o Non-binary
- o Prefer not to say
- o Other: _____

Q3: Are you an educator who teaches on one of the following Athletic Therapy programs?

- o Yes
- o No

Q4: Are you currently working in Ireland?

- o Yes
- o No

Q5: How many years of teaching experience do you have?

_____

Q6: What is/are your educational qualification you have achieved to date? Tick as many is relevant to you.

- o PhD/ Doctoral Degree
- o Masters Degree
- o Post Graduate Diploma
- o Bachelor degree (Honours)
- o Bachelor degree (Ordinary)
- o Higher Certificate (Level 6 of the National Framework of Qualifications)
- o Other: _____

Q7: Do you have any formal teaching qualification(s)?

- o Yes

- o No
- o If Yes, can you state the qualification(s) you have been awarded and level?

_____

Q8: What discipline within Athletic Therapy education do you currently teach? Tick as many as appropriate

- o Physiology
- o Psychology
- o Biomechanics
- o Injury Prevention
- o Nutrition
- o Neuro-Musculoskeletal evaluation and assessment
- o Medical conditions and disabilities
- o Acute Care of Injuries and Illnesses
- o Therapeutic interventions
- o Conditioning and Rehabilitative exercises
- o Pharmacology
- o Professional Responsibility and Development

Q9: Have you heard of Metacognition?

- o Yes
- o No

If Yes: What is metacognition in your opinion? _____

Section 2: Educators Self-reflective Metacognitive Questions about Current Teaching practice

Educators Self Questions on Metacognition in the classroom	
Read the following statements carefully.	
Please use the rating scale provided to respond to answer each of the questions below by indicating how frequently you ask yourself these metacognitive questions about your current teaching practice in an Athletic Therapy programme during an academic semester.	
1- Never, 2 - Rarely, 3- Sometimes, 4 – Often, 5- Always.	
Q1	What do I think students already know about this topic?
Q2	What evidence do I have for my thinking?
Q3	How can I make this material personally relevant for my students? Why do I think this?
Q4	What mistakes did I make the last time I taught this?
Q5	How can I not repeat these mistakes?

Q6	Why do I think its important for students pursing a variety of careers to learn ideas in my module?
Q7	What are my assumptions?
Q8	How does success in this module relate to my student's career goals?
Q9	How might I reveal these connections to them?
Q10	What do I want my students to be able to do by the end of this module?
Q11	What do I want my students to be able to do in 5 years' time?
Q12	What do I notice about how students are behaving during this class session?
Q13	Why do I think this is happening?
Q14	What language or active learning strategies am I using that appears to be facilitating or impeding learning?
Q15	How is the pace of the class going?
Q16	What could I do right now to improve the class session?
Q17	In what ways am I effectively reaching my goals for the students through my teaching?
Q18	How could I expand on these successful strategies?
Q19	In what ways is my approach to teaching in this course not helping students learn?
Q20	How can I change my teaching strategies to address this?
Q21	How is my approach to teaching this module different from the last time I taught it? Why?
Q22	How can I change my teaching strategies to address this?
Q23	How is my approach to teaching this module different from the last time I taught it? Why?
Q24	How do I think today's class session went?
Q25	Why do I think that? What evidence do I have for that?
Q26	How did the ideas of today's class session relate to my previous class session?
Q27	To what extent do I think the students saw these connections from previous to current class?
Q28	How will what I think about influence my preparation for the next time?
Q29	What evidence do I have that students learned what I think they learned?
Q30	What advice would I give students next year about how to learn the most in this module?
Q31	If I were to teach this module again, how would I change it?
Q32	What might keep me from making those changes?
Q33	How is my thinking about teaching changing?

(Tanner, 2012)

Section 3: Implementation of Metacognitive Teaching Strategies

Implementation of Metacognitive Teaching Strategies	
Read the following statements carefully.	
Please use the rating scale provided to respond to answer each of the questions below by indicating how frequently you use each of the following metacognitive teaching strategies in your current teaching practice in an Athletic Therapy programme during an academic semester.	
1- Never, 2 - Rarely, 3- Sometimes, 4 – Often, 5- I don't know what this is.	
Q1	Peer assessment using mark criteria I provide.
Q2	Self-assessment using mark criteria I provide.
Q3	Group work where students must explain their thinking/rationale to each other.
Q4	Ask students what they already know about a topic before I teach it.
Q5	Ask students to articulate what they do and/or don't understand about a topic, either verbally or as a written exercise.
Q6	Ask students to consider and evaluate different approaches to solving a problem.
Q7	Encourage students to use checklists or prompts to help them evaluate whether they have correctly answered a problem or understood a concept.
Q8	Explicitly categorise thinking or learning, for example using Bloom's taxonomy of remember, understand, apply, analyse, evaluate, create.
Q9	Student "think alouds", where I ask students to talk through what they are thinking when they solve a problem.
Q10	Staff "think alouds", where I talk through my thinking while solving a problem.
Q11	Ask students to predict possible outcomes in an experiment or scenario, then make observations, then explain the outcome.
Q12	Ask students to reflect on how they approached a task or assignment and what they would do differently next time.
Q13	Ask students to rate how confident they are in their answer.
Q14	ConcepTest: I pose a challenging question, students vote on an answer, students discuss, students vote again.
Q15	Draw concept maps, also known as mind maps.
Q16	Explain to students how to separate key issues from less important information, for example in a text or research paper.

(Dennis & Somerville, 2022)

Appendix 9 - Interview Guide

Thank you for joining me today for this interview.

I would like to start by reviewing the study procedures with you. If you have any questions, please feel free to ask.

The purpose of this interview is to help us understand what Athletic Therapy educators in Ireland knowledge and understanding of metacognition and what the facilitators and barriers to implementing metacognitive teaching strategies are in Athletic Therapy education.

During our discussion, I am interested in understanding your knowledge of metacognition and what and the factors that in your opinion, may affect the implementation of metacognitive teaching strategies in athletic therapy education.

I would like you to know that there are not right or wrong answers in this discussion, as I am interested specifically in your own individual perspective. Please answer the questions to the best of your ability, and feel free to ask for further clarification or prompts at any stage. Please remember that you are not required to discuss topics that sensitive to you, so if you feel uncomfortable at any stage, you may refuse to answer any of the questions. You may also withdraw from the discussion at any time.

Can I have your verbal consent to proceed with the recording of the interview?

Before, we start, do you have any questions for me?

Introductory Section:

1: What discipline do you teach within Athletic Therapy in Ireland?

2: What specific modules do you teach within Athletic Therapy in Ireland?

3: How would you describe your teaching?

Section 1: Views on Metacognition in Athletic therapy Education

4: What does metacognition mean to you?

Definition of metacognition for participant:

Metacognition is viewed as thinking about thinking, a higher order cognitive process that allows individuals to regulate, reflect and evaluate knowledge and learning, identify gaps in knowledge and take remedial action needed to address this.

Now that you are familiar with the definition of MC, can you now tell me what metacognition means to you?

5: What do you think the role of metacognition is in higher education?

6: What do you believe the role of metacognition is specifically in Athletic therapy?

7: How do you think you apply your understanding of metacognition into your own teaching practice?

8: What do you believe is the educators' role in developing student's metacognition?

9: How important, do you believe that students understand what metacognition is and why it may aid their learning?

10: How important do you think that educators understanding of what metacognition is and how it may impact students learning?

Section 2: Implementation of metacognitive teaching strategies in athletic therapy education

11: What do you believe is your experience of using metacognitive teaching strategies in the classroom?

12: What kind of metacognitive teaching strategies methods or techniques would your students benefit from?

13: How much time do you think you would need to spend preparing to implement metacognitive strategies into your practice?

14: When do you think the implementation of metacognitive strategies should take place?

15: How do you think this implementation should occur?

Should this be a programme wide adoption or staff dependent?

16: Are there any resources that you think you may need before implementing metacognitive strategies into your practice?

17: What would like to see as the future of metacognitive teaching strategies?

Now that we have discussed metacognitive teaching strategies in Athletic therapy education, are there any other factors that you believe should be considered? Or would influence your use of them?

Prompts for acquiring further detail

When you say _____, what do you mean by that?

Would you mind expanding on your thoughts on _____ more for me?

Just going back to what you said _____, can you elaborate more than for me?

When you say that strategy should include _____, are you talking about ___?

You briefly mentioned _____, is this very important in your opinion?

Tell me why you think this?

Tell me more about why you have that opinion or why do you say that?

Supporting content questions

Questions related to metacognitive teaching strategies

a) When should this be done?
b) What are the other demands may get in the way of an adopting metacognitive strategies into your practice?
c) Do you see any shortcomings and weaknesses to metacognition as a theory?
d) What aspects do you feel are critical to the development of metacognition?
e) Are there other staff/ resources/ equipment that may impact the implementation and adoption of these metacognitive strategies into your practice?

Appendix 10 - Interview Guide

Thank you for joining me today for this interview.

I would like to start by reviewing the study procedures with you. If you have any questions, please feel free to ask. The purpose of this interview is to help us understand what the facilitators and barriers to implementing metacognitive teaching strategies are in Athletic Therapy education. A barrier is a factor that makes it harder or prevents you from implementing metacognitive teaching strategies. A facilitator is a factor that make is easier for you to implement metacognitive teaching strategies into your teaching practice in athletic therapy education.

During our discussion, I am interested in understanding what and the factors that in your opinion, may facilitate or be a barrier to the implementation of metacognitive teaching strategies in athletic therapy education. I would like you to know that there are not right or wrong answers in this discussion, as I am interested specifically in your own individual perspective. Please answer the questions to the best of your ability, and feel free to ask for further clarification or prompts at any stage. Please remember that you are not required to discuss topics that sensitive to you, so if you feel uncomfortable at any stage, you may refuse to answer any of the questions. You may also withdraw from the discussion at any time.

Can I have your verbal consent to proceed with the recording of the interview?
Before, we start, do you have any questions for me?

Views on barriers to the implementation of metacognitive teaching strategies in Athletic Therapy Education?

Note: Barriers – things that make it harder or stop the adoption/ implementation of metacognitive teaching strategies

1: What do you believe are the main barriers to <u>implementing</u> metacognitive teaching strategies in Athletic Therapy education?

2: What do you think are the barriers for <u>long term adoption</u> of these metacognitive teaching strategies?

3: Do you have any ideas on why these barriers exist?

4: Do you have any ideas on how to overcome the above-named barriers for successful implementation into teaching practice?

Prompts for acquiring further detail

You mentioned _____ as a barrier, how do you think that acts as a barrier?

What exactly do you mean by _____?

Can you further explain what you mean by _____?

Would you be able to tell me more about _____ as a barrier?

Why do you believe _____is a barrier?

Section 3 - Views on facilitators to the implementation of metacognitive teaching strategies in Athletic Therapy Education?

1: What do you believe are the main facilitators to implementing metacognitive teaching strategies in Athletic Therapy education?

2: What are the facilitators for long term adoption of these metacognitive teaching strategies?

3: How best do you think these facilitators for metacognitive teaching strategies can be supported?

Any final comments on our discussions today?

Prompts for acquiring further detail

You suggested that _____ could be a facilitator, could you explain that a bit more for me?

Why do you think _____helps as a facilitator with implementation?

Previously, you said _____, do you mind expanding on this more?

When you say _____, what do you mean by that?

Prompts will be dependent upon the ideas and comments put forward by the participant in the interview.

Questions related to potential barriers

a) What are the other demands that might get in the way of adopting these metacognitive strategies into your practice?
b) Do you think many educators view the use metacognitive teaching strategies as a barrier?

Questions related to potential facilitators

a) In your opinion, who needs to support the adoption and implementation of metacognitive teaching strategies for it to be successful in your program?
b) What things do you believe, can impact the long-term success of metacognitive teaching strategies in Athletic Therapy education?
c) How do you think the adoption of metacognitive teaching strategies will benefit your students learning?

Appendix 11 - Standards for the Reporting Qualitative Research (SRQR) Checklist (O'Brien et al., 2014)**.**

SRQR Reporting Guidelines		
Topic	**Reporting Item**	**Page Number**
Title and Abstract		
Title	Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended.	1
Abstract	Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions.	1
Introduction		
Problem formulation	Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement.	2- 5
Purpose or research question	Purpose of the study and specific objectives or questions.	5
Methods		
Qualitative approach and research paradigm	Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	5 - 6
Researcher characteristics and reflexivity	Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability.	6
Context	Setting/site and salient contextual factors; rationale**	6-7
Sampling strategy	How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	6-8

Ethical issues pertaining to human subjects	Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues.	6
Data collection methods	Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	6-7
Data collection instruments and technologies	Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study.	6-7 Supplementary Files 2 and 3
Units of study	Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results).	6
Data processing	Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts.	7-8
Data analysis	Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	7-8
Techniques to enhance trustworthiness	Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	8
Results/Findings		
Synthesis and interpretation	Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory.	6-17
Links to empirical data	Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings.	9-25
Discussion		
Integration with prior work, implications, transferability, and contribution(s) to the field	Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field.	25 - 31
Limitations	Trustworthiness and limitations of findings.	31 - 32
Other		

Conflicts of interest	Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed.	32
Funding	Sources of funding and other support; role of funders in data collection, interpretation, and reporting.	Reported separately on Title Page

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.