Investigating the Perceived Impact on the Professional Work of Sports Coaches and Practitioners After Completing Online Coach Education Material Underpinned by Ecological Dynamics

by

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Abstract

This thesis investigates the impact perceived by sports coaches and practitioners after interacting with online education material underpinned by ecological dynamics and *applying* the ideas in their professional practice**.** **Chapter 1** introduces the thesis and emphasizes the paucity of research investigating the impact (positive or negative) perceived by coaches and practitioners after engaging with online education material underpinned by an ecological dynamics framework. **Chapter 2** provides a critical overview and critique of the literature relating to both traditional and contemporary views of skill acquisition in sports. Moreover, this chapter discusses key concepts of ecological dynamics, such as constraints and affordances. After discussing ecological dynamics, this chapter discusses how coaches learn and the growing need and desire that movement professionals have for online professional development, which is critical to helping shape the way education material can better meet individual needs. The chapter concludes by covering previous research and the impact coaches and practitioners perceived from the online learning opportunities they interacted with (they were not underpinned by ecological dynamics), while delineating possible benefits and shortcomings they found. **Chapter 3** presents the methodological approaches and standpoints taken. Rationale relating to the research paradigm is discussed alongside the mixed-methods approach taken in the thesis; the chapter concludes by discussing research quality, rigor, and ethical considerations. **Chapter 4** introduces the quantitative data, which contextualizes the qualitative data that follows. The first theme, which serves as the principal theme, is presented and discussed, offering rich insight into the lived experiences of the participants and the changes they made in their coaching after interacting with the online educational material. **Chapter 5** presents and discusses the first and second sub-themes for the principal theme, highlighting the confidence coaches and practitioners perceived that supported the changes they made in their coaching. In addition to changes in their confidence, their ability to design changing movement problems to assist athletes in becoming more adaptable is discussed. **Chapter 6** introduces the second theme, which presents and discusses challenges and opportunities that coaches and practitioners perceived after applying contemporary skill acquisition ideas in their professional practice. **Chapter 7** discusses the significant conclusions as demonstrated by the participants' experiences in the previous chapters and elucidates the overwhelmingly positive outcomes of the thesis, addressing how the research contributes new knowledge to the field and advances practice. **Chapter 8** concludes the thesis by discussing pertinent research implications, notably the contributions to existing research and how the findings are impactful to others (e.g., coaches and universities). Finally, the limitations of the study are discussed, followed by recommendations for future research.

Candidate Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of the University of Gloucestershire and is original except where indicated by specific reference in the text. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other education institution in the United Kingdom or overseas.

Any views expressed in the thesis are those of the author and in no way represent those of the University.

Signed  Date: April 2024

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Dedication

This thesis is dedicated to my family, especially my wife Katie, and my three children, William, Frances, and Joseph.

Doctoral Research Outputs

Peer-reviewed Journal Articles

Yearby, T., Myszka, S., Roberts, W. M., Woods, C. T., & Davids, K. (2022). Applying an ecological approach to practice design in American football: some case examples on best practice. *Sports Coaching Review*, 1–24. https://doi.org/10.1080/21640629.2022.2057698

Myszka, S., **Yearby, T.**, & Davids, K. (2023). Being water: how key ideas from the practice of Bruce Lee align with contemporary theorizing in movement skill acquisition. *Sport, Education and Society*, *29*(4), 451–467. https://doi.org/10.1080/13573322.2022.2160701

Myszka, S., **Yearby, T.,** & Davids, K. (2023). (Re)conceptualizing movement behavior in sport as a problem-solving activity. *Frontiers in Sports and Active Living*, *5*, 1130131. https://doi.org/10.3389/fspor.2023.1130131

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Conference, Symposium, and Workshop Presentations

Yearby, T. (2021, May 20). *Representative co-design: Embedding athletes within the practice design process.* 4th Annual Sport Movement Skill Conference (virtual event).

Yearby, T. (2021, December 10). *Viewing the weight room and movement through a different lens.* San Francisco 49ers (virtual event).

Yearby, T. (2023, September 11). *Viewing the world through a different lens: Helping coaches develop better problem solvers*. Sport & Human Performance Group, Skill Acquisition Research Symposium (in-person event) at Sheffield Hallam University, Sheffield, England.

Yearby, T. (2023, September 14–23). Two presentations, titled "*Reconceptualizing the role of sports performance coaches" and "Reconceptualizing the warm-up,"* and an on-field movement session with an American football team in five cities throughout China (Guangzhou, Chengdu, Beijing, Shenyang, and Shanghai). Active Masters: Active Lifestyle.

Yearby, T. (2023, October 5). *Guiding their search: Effective communication for enhancing skill adaptability.* 6th Annual Sport Movement Skill Conference (hybrid event), Minneapolis, Minnesota.

Yearby, T. (2024, February 16). *Unpacking ecological dynamics*. The Skill Acquisition Retreat, powered by Emergence (in-person event), Phoenix, Arizona.

Yearby, T. (2024, April 11). *Ecological dynamics in the high performance setting* (in-person event). United States Ski & Snowboard, Park City, Utah.

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have shared conversations with over the past four years that undeniably shaped my thinking. Thank you.

I hope that anyone who reads this thesis is positively impacted. To educational providers, I hope you find something useful to assist you in the development of content to better meet learners where they are, helping them advance their applied practice. For coaches and practitioners, hopefully, this thesis helps shape your craft to assist those you work with in your unique learning environment, helping them to adapt their skills, move well again, or fall in love with movement. Finally, to anybody reading this who will build upon this program of research, make the most of it.

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Chapter 1: Introduction and Thesis Structure

1. Introduction

Over the last 25 years, the expansion of internet access and connectivity has resulted in rapid growth in online learning opportunities (Allen & Seaman, 2005; Broadbent & Poon, 2015; Greenhow et al., 2022), and as such, the internet is viewed as a valued resource for learning and knowledge exchange, including within the sport and physical activity domains (e.g., Davis, 1998; Kirk et al., 2006; Blumenstein et al., 2012; Pope et al., 2015). In sports, coaches now prefer using the internet as a learning resource over more traditional modes of learning because it affords low-cost and convenient access to new knowledge and ideas in developing areas (Koh et al., 2017; Pope et al., 2015). In recent years, the advent of platforms and hosting technologies (e.g., Zoom, MS Teams, LearnDash) has made both free and paid online coach education material more accessible to wider audiences. However, while recent studies (e.g., Buchner & Plessl, 2022; Driska, 2018; Koh et al., 2017; Sackey-Addo & Pérez, 2016; Santos et al., 2019) have suggested that coaches have positive experiences from engaging with online learning material, both from searching the internet and taking coach education courses, there is a dearth of research investigating the impact perceived (positive or negative) by coaches and practitioners after interacting with contemporary skill acquisition ideas (i.e., ecological dynamics) online and applying the key principles in their professional practice.

Ecological dynamics has received considerable attention in the scientific and coaching literature and is viewed as a contemporary framework of skill acquisition (e.g., Gray, 2021; McKay et al., 2021; Morris et al., 2022; Myszka et al., 2023a; Strafford et al., 2018; Yearby et al., 2024). Moreover, there is empirical support for ecological approaches in sporting contexts (e.g., Esteves et al., 2011; Travassos et al., 2012). By harnessing the overlap between empirical knowledge

and experiential knowledge, the ecological dynamics framework affords coaches and movement scientists opportunities to elucidate how ecological ideas can be applied in practice and training sessions to help athletes adapt their skills and solve more problems they face in sports (Rothwell et al., 2020). Despite an array of literature outlining how an ecological dynamics framework can support skill acquisition and expertise in sports (e.g., Davids et al., 2015; Woods et al., 2020a), no research exists that illustrates whether online educational material underpinned by ecological ideas can support coaches in advancing their applied practice and help assist in developing their skills.

Therefore, this thesis has two targeted areas of focus, which are intertwined: a) understanding more about coaches' and practitioners' online engagement experiences with professional learning opportunities underpinned by an ecological dynamics framework; and b) the investigation of the utility of the framework and the underpinning ideas in the unique professional setting of each participant. It is important to investigate the participant's perceptions 'after' applying the ideas versus testing their ability to answer theoretical questions on an exam to understand the potential power and helpfulness of the ecological dynamics framework. The 'applied' emphasis is critical to learning more about the strengths and weaknesses they experienced by 'doing.'

1.1. Thesis Aims and Objectives

The principal aim of this thesis is to investigate the perceived impact on the professional work of sports coaches and practitioners after completing online coaching education material underpinned by an ecological dynamics framework. The objectives are to:

1. Investigate the strengths and limitations coaches and practitioners perceive in their coaching after applying ideas learned from online education courses underpinned by an ecological dynamics rationale.
2. Understand the extent to which the educational material has helped the confidence level of coaches and practitioners in applying ecological ideas within their everyday practice.
3. Investigate how the educational material may have (or not) helped them in their professional practice.

To achieve these aims and answer the principal research question (i.e., did coaches and practitioners perceive any impact in their practice after interacting with and applying online educational content underpinned by an ecological dynamics framework?) I employed a mixed-methods approach, utilizing a survey with both closed- and open-ended questions (the first stage of the study) and semi-structured online interviews with a sub-sample of participants (the second stage) to further explore the significance of the applied ideas. Using a mixed-methods approach allowed me to draw upon the strengths of each method to answer my research question (Morgan, 2007; Queirós et al., 2017). Specifically, the survey offered participants an opportunity to delineate their applied experiences, which gave me a base understanding, and the semi-structured interviews complemented their responses, creating ample opportunities for me to investigate the nuances of their applied practice.

1.2. How Will My Research Be Helpful and Why Is It Needed?

Outside of learning whether movement professionals (e.g., sport coaches and strength and conditioning specialists) were positively or negatively impacted or benefited from the pre-recorded courses and live interactions, my research will uniquely contribute to knowledge by learning if the ecological dynamics

framework delivered exclusively online helps professionals living in different areas of the world and those who work in different sports and professions. These findings will help elucidate more about the ‘reach’ and ‘depth’ of ecological dynamics, and the results can shape the delivery of education (especially online) by universities, bespoke education companies, and national governing bodies (NGB). Furthermore, my research will investigate the experiences of those who have varying knowledge of ecological dynamics (i.e., just heard about it or have been using the ideas already) and experience (i.e., length of time) in coaching (e.g., position coaches), teaching (e.g., physical education), and the clinical setting (e.g., physical therapists), as well as those who work with athletes and patients with varied movement histories. Learning more about the areas mentioned above will advance both theory and practice and delineate the power and utility of ecological dynamics and the ability of the framework to improve the skill and performance of both athletes and coaches.

Not only can the research benefit movement professionals by discovering more about how they like to learn and what gives them the confidence to support those they work with to increase their development, but the results will also show whether athletes and patients benefit from a contemporary approach to skill acquisition. This understanding will confirm what coaches and practitioners have already been doing or provide them with a framework to adapt their practice, ultimately benefiting the athletes or patients. With online learning becoming more common, the results will support universities and their stakeholders who do not have online offerings teaching the theory of ecological dynamics but are interested in adding modules and creating an interactive community of practice. Beyond skill acquisition, the findings from this research could also inform other areas of online education because of how ecological dynamics courses are

delivered, which are not taught in a rigid, fixed, or didactic way similar to most university teachings (more on this in sections 2.4, 7.1.6., and 7.2.). Moreover, this research can offer interested parties (e.g., NGB and bespoke education companies) a better understanding of the value and benefit derived from participants feeling like they are part of a greater community—bringing online learning to life—which they experienced through live interactions with other like-minded individuals (e.g., see Dante's comment in section 5.1.1). In conclusion, with the dearth of research about the perception and utility of ecological dynamics learned online, this research will greatly benefit science and practice.

1.3. Structure of the Thesis

Chapter One: Introduction

This chapter introduces the thesis and emphasizes the paucity of research investigating the impact (positive or negative) perceived by coaches and practitioners after engaging with online education material underpinned by an ecological dynamics framework and applying the ideas in their unique learning environment. In conclusion, the purpose and aims of the study are outlined, and the significance of my research is addressed, which describes how it will advance science and practice.

Chapter Two: Literature Review

This chapter provides a critical overview and critique of the literature relating to both traditional and contemporary views of skill acquisition in sports. Moreover, this chapter discusses key concepts of ecological dynamics, such as constraints and affordances, and introduces the key principles of *nonlinear pedagogy* (NLP) and other ideas espoused by ecological dynamics and how the ideas are used by coaches in sports. After discussing ecological dynamics and NLP, this chapter discusses how coaches learn and the growing need and desire

that movement professionals have for online professional development, which is critical to helping shape the way education material can better meet individual needs. The chapter concludes by covering previous research and the impact coaches and practitioners perceived from the online learning opportunities they interacted with (they were not underpinned by ecological dynamics), while delineating possible benefits and shortcomings they found.

Chapter Three: Methodology

This chapter presents the methodological approaches and standpoints taken. Rationale relating to the research paradigm is discussed alongside the mixed-methods approach taken in the thesis; the chapter concludes by discussing research quality, rigor, and ethical considerations.

Chapter Four: Coaching Changes (Harnessing the Performer-Environment Relationship)

This chapter introduces the quantitative data, which contextualizes the qualitative data that follows. The first theme, which serves as the principal theme, is presented and discussed, offering rich insight into the lived experiences of the participants and the changes they made in their coaching after interacting with the online educational material.

Chapter Five: Increased Coaching Ability Leads to a Platform for Athletes to Evolve Their Skills

This chapter presents and discusses the first and second sub-themes for the principal theme, highlighting the confidence coaches and practitioners perceived that supported the changes they made in their coaching. In addition to changes in their confidence, their ability to design changing movement problems to assist athletes in becoming more adaptable is discussed. Finally, changes in

the athlete's movement skill set are discussed, followed by additional changes the coaches and practitioners experienced in their training, such as patience, reflecting on their professional practice, and analyzing movement from an ecological perspective.

Chapter Six: Challenges Identified and Opportunities Illuminated to Improve Coaching Skills

This chapter introduces the second theme, which presents and discusses challenges and opportunities that coaches and practitioners perceived after applying contemporary skill acquisition ideas in their professional practice. Other challenges are discussed, such as difficulties adhering to a contemporary pedagogical approach or explaining to others why they approach their practice differently.

Chapter Seven: Advancing Theory and Practice

This chapter discusses the significant conclusions as demonstrated by the participants' experiences in the previous chapters and elucidates the overwhelmingly positive outcomes of the thesis, addressing how the research contributes new knowledge to the field and advances theory and practice.

Chapter Eight: Conclusion

This chapter discusses pertinent research implications, notably the contributions to existing research and how the findings are impactful to others (e.g., coaches and universities). Finally, the limitations of the study are discussed (e.g., the inability to observe participant behaviors in person), followed by recommendations for future research.

Chapter 2: Literature Review

2. Introduction

This chapter starts with a brief review of a traditional approach to skill acquisition, followed by an extensive discussion of a more contemporary view—an ecological dynamics framework—that serves as a foundational pillar for the research project. An extensive discussion about ecological ideas is needed for two main reasons before reviewing the literature about online professional development opportunities and the impact perceived from them. First, as mentioned in the introduction, this study aims to investigate the impact participants perceive after interacting with and applying "ecological ideas" in their professional practice. Every learning opportunity within the Emergence portfolio, which is the company where participants engaged in online learning (see Chapter 3 and section 7.2 for more details), is underpinned by ecological dynamics. This emphasizes why detail needs to be provided because the relationship between ecological dynamics and online learning opportunities is of particular interest. Secondly, readers need to be familiar with the differences between the two approaches to skill acquisition to better understand the questions asked on the questionnaire and in the semi-structured interviews. The familiarity with the literature sets the tone, making it easier to see the gaps my research will fill. After covering ecological dynamics, the chapter continues with a review of the literature about the growing desire and need for online professional development for coaches (see Koh et al., 2017; Pope et al., 2015), including a discussion about how coaches are currently spending their time learning to advance their practice and their preferences for continuing education. Next, literature is reviewed about the perceived impact on the professional work of sports coaches and practitioners after engaging with courses ranging from formal national coach certification programs to nonformal sport-specific courses targeted at distinct subgroups.

Particular emphasis is placed on learning about their experiences after applying key ideas from the online learning opportunities. Prior to the conclusion of the chapter, four gaps in the literature will be critically reviewed, with the most notable issue being the dearth of research investigating the impact perceived by sports professionals after interacting with and applying ideas underpinned by ecological dynamics.

2.1. Research Overview

From journal articles and books to online courses and conversations with other professionals, there are numerous ways available for sports coaches and practitioners to advance their craft. An area that has grown rapidly over the past few decades is online learning (Allen & Seaman, 2005; Broadbent & Poon, 2015; Greenhow et al., 2022) because of its cost-efficiency, ease of accessibility, and ability to meet individual learning needs (Koh et al., 2017; Pope et al., 2015). Moreover, research has shown that the perceived value of coach education courses is high (e.g., Misener & Danylchuk, 2009; Vargas-Tonsing, 2007), presenting exciting new opportunities for researchers to investigate and learn more about what contributed to the positive experiences and the impact on the daily practice of sports coaches and practitioners, specifically after interacting with online options. However, there is limited research (e.g., see Buchner & Plessl, 2022; Driska, 2018) that has attempted to assess the effectiveness of how online learning material impacts coaching abilities, and even less when underpinned by ecological dynamics.

2.2. A Background to Ecological Dynamics

For decades, movement scientists have been trying to explain coordination, control, and the acquisition of skill (e.g., Anson et al., 2005; Button et al., 2020; Davids et al., 2008; Schmidt, 1975) with both traditional and

contemporary views proposed. A traditional view sees the performer as a processor of information, with comparisons to the brain operating like a computer (Schmidt & Wrisberg, 2008). Information-processing theories propose that information from the environment (i.e., input) is identified and processed using a variety of internal operations before the system produces an action (i.e., output; Schmidt & Wrisberg, 2008). Through repeated experience, representations (i.e., a set of motor commands that control movement), motor programs (i.e., a series of subroutines organized into the correct sequence to perform a movement), and/or schema (i.e., a mental model responsible for the organization and control of movement; Schmidt, 1975) are stored 'somewhere' in the brain (Davids et al., 2008). The representations/motor programs are putatively stored in long-term memory centers of the brain and retrieved when an athlete needs to perform a skill. Hence, skill is thought to be an *acquired* entity subject to processes of *skill acquisition* (Davids et al., 2008; Schmidt & Wrisberg, 2008; Teques et al., 2017).

Cognitive theories of human behavior, which suggest a computational regulation of perception and action, have been labeled 'indirect' because, in this view, the world cannot be known directly but only through a stored representation of it in the mind (Araújo & Davids, 2011; Michaels & Carello, 1981). A key concern with this view is how motor commands work without direct access to the world. In 2006, Warren asked: "If perceptual states are representations, how is it possible for the agent to know what they stand for without presuming some other direct access to the world" (p. 361)? Further, the notion of stored internal models presents an *organismic asymmetry* (Davids & Araújo, 2010) in its approach to skill acquisition, which is problematic because it neglects environmental constraints on behavior (Dunwoody, 2006; Williams et al., 1999). Moreover, in 2011, Araújo and Davids aptly stated, "A particular challenge for cognitive

science models of skill acquisition and performance has been to explain how cognition and perceptual processes regulate complex multi-articular actions in dynamic environments" (p. 12). During practice and competition, while embedded in dynamic problem-solving activities, athletes must continually (re)organize their available degrees of freedom (DoF, e.g., components of the body; Bernstein, 1967), bringing them into relation with one another in an attempt to successfully navigate the ever-changing performance environment, which is seemingly difficult (maybe impossible) if they must use a variety of internal operations before the system finally produces an action.

In comparison, a contemporary view of skill acquisition attempts to explain movement behavior in a very different way. From an ecological dynamics rationale, skill acquisition, which has been reconceptualized as *skill adaptation*, is viewed as "the emergence of an adaptive, functional relationship between an organism and its environment" (Araújo & Davids, 2011, p. 7). Ecological dynamics combines key ideas mainly from ecological psychology (Gibson, 1979), dynamical systems theory (see Williams et al., 1999; Thelen & Smith, 2006; Davids et al., 2008), the complexity sciences (Bak, 1996), coordination dynamics (e.g., Kelso, 1995), and evolutionary biology (Kauffman, 1993), offering the sporting landscape a transdisciplinary framework for understanding skill, development, and performance (Button et al., 2020; Renshaw et al., 2019). The original ideas from these scientific domains, especially those important for sports coaches, which will be discussed below, were initially conceptualized for sport scientists and practitioners in the works of Davids et al. (1994), Handford et al. (1997), and Araújo et al. (2006), who proposed an embedded role for cognition, perception, and action (Seifert & Davids, 2017).

Informed by research from ecological psychology, most notably that of James J. Gibson (1979), the *individual-environment relationship* is viewed as the appropriate scale of analysis for studying emergent behavior, where there is a mutual exchange between the individual and the environment. From an ecological dynamics perspective, it is acknowledged that movements do not occur in isolation; how athletes behave can only be understood in relation to the specific environmental context in which behaviors emerge (Bernstein, 1967, 1996; Renshaw et al., 2019). In 1979, Gibson stated, "We must perceive in order to move, but we must also move in order to perceive" (p. 223). Therefore, in sports, when an athlete moves, they both provide and perceive information from the surrounding energy flows, which specifies *opportunities for action* unique to them (referred to as *affordances* in ecological psychology; Blau & Wagman, 2023; Chong & Proctor, 2020; Gibson, 1979) (see section 2.2.2 for more detail). Affordances are shaped by the interacting constraints, and they can emerge, decay, or persist. *Constraints* are *"boundaries or features that limit motion of the entity under consideration"* (Newell, 1986, p. 347) (see section 2.2.1 for more detail). The intertwined and inseparable processes of perception, cognition, and action emerge from the interactions between the task, individual, and environmental constraints, helping an athlete to coordinate more than simply a motor response but a *functional behavioral unit* (sometimes called a synergy) in the form of an *integrated movement solution (IMS)* to fit the dynamical needs of the problems faced in sports (Davids et al., 2008; Myszka et al., 2023a, 2023b; Newell, 1986). In ecological dynamics, athletes and sports teams are considered complex adaptive systems, where the prevailing constraints of the task, individual, and environment (Handford et al., 1997) shape the IMS that emerges (Araújo, et al., 2006; Myszka et al., 2023a, 2023b; Rothwell et al., 2020). Under

constraints, which act as information, human movement systems—open systems free to exchange energy with the environment—are capable of spontaneously self-organizing (i.e., an IMS coming to be). Further, athletes are capable of becoming *attuned* (i.e., gaining increased sensitivity to key information sources; Button et al., 2020) through experience gained from interacting with 'alive movement problems' (Myszka et al., 2023a, 2023b; Yearby et al., 2022) representative of a specific performance context such as a sport or game. Enhanced attunement leads to the exploitation of available affordances in a performance context, where athletes become increasingly capable of organizing movement solutions to solve more problems in sports.

Additionally, it is critical to acknowledge that constraints do not act in isolation but coalesce together to shape behavior, meaning that continuous interactions, including an individual's moment-to-moment intentions, shape their perception-action couplings as they attempt to negotiate the environment to use available affordances (Button et al., 2020; Newell, 1986). Here, the landscape of nested constraints and, therefore, affordances are viewed as ever-changing, so it is essential to consider that a change in the confluence of interacting constraints may lead to changes in the emerging movement strategy whereby skilled behavior evolves over timescales of learning and development (Button et al., 2020; Woods et al., 2020a). For example, assuming the task and environmental constraints are similar (e.g., the initial play called, the offensive and defensive formation, the team played, wind and sun conditions, and time remaining on the play clock and in the game), two different quarterbacks in American football who have different individual constraints will perceive a different *affordance landscape* (Rietveld & Kiverstein, 2014) under the interacting constraints. It should be acknowledged that it is difficult to convey in writing how dynamic or *alive* the

movement problem will be during competition. This ‘aliveness’ means the unfolding problems are replete with opportunities for interaction, where affordances rapidly emerge and decay (for more on alive movement problems, see section 2.2.5; Yearby et al., 2022).

However, it must be acknowledged that critics of constraints-led coaching claim that there remains room for other approaches, informed by competing theoretical perspectives, to provide beneficial practical guidance, contending that sports coaches and practitioners lean on an 'it depends' perspective throughout the coaching process (Collins et al., 2022). Practically speaking, this approach would see a coach believing in and harnessing both traditional and contemporary approaches to skill acquisition when working with players in practice to help prepare them for competition (Bobrownicki et al., 2023).

Despite these criticisms, a recent report (2016) on the quality and standards of university-level coach education courses by the International Council for Coach Education (ICCE) highlighted the relevance and value of ecological dynamics for coach education in undergraduate degrees (for a general discussion of the ICCE report, see Lara-Bercial et al., 2016). In compiling evidence of coach education for the report, the ICCE consulted with an international panel of 40 experts in coaching science, teaching, and research to evaluate high-quality coach education and training in international universities. They proposed that ecological dynamics/constraints theory is one of two necessary, distinct theoretical frameworks to support the delivery of skill acquisition and motor learning theory in coaching science undergraduate degrees (see original ICCE report, p. 20). As a result these two conceptually-different frameworks for understanding skill acquisition and motor learning are

incorporated into the curricula for degree awards in many universities across the world.

In the following sections, key ideas in ecological dynamics will be extensively discussed (specifically ideas pertinent to sports coaches), since the approach forms one of the two foundational pillars of this study. The second pillar is the impact coaches perceive after interacting with ecological ideas online to improve their coaching knowledge and help the athletes they partner with perform more skillfully in sports. First, the notion of constraints and affordances will be unpacked before discussing applying an ecological approach to practice design, which includes harnessing principles of *nonlinear pedagogy* (NLP, a framework based on the theory of ecological dynamics; Chow et al., 2006, 2016, 2022; Yearby et al., 2022).

2.2.1. Constraints

As discussed earlier, constraints can be conceptualized as informational boundaries that can shape, guide, or nudge the reorganization of complex neurobiological systems, which are open systems continuously exchanging energy with the environment, meaning they can influence the environment and be influenced by it too (Davids et al., 1994; Kugler & Turvey, 1987; Pinder et al., 2012; Renshaw et al., 2019). Conceptualizing constraints as informational boundaries is important because actions are not caused by constraints; rather, some actions are excluded by constraints (Gray, 2021; Newell, 1986). In this way, constraints act as information that influences the behaviors that are possible in complex neurobiological systems that can self-organize under constraints.

For example, in basketball, if the point guard is in the midst of an overhand layup when a defender attempts to block it by raising their arms upwards, the act of shooting can be dynamically adapted by accepting the affordance (raised arms

of the defender) inviting the player to shoot an underhand layup to avoid the defender's outstretched arms in an attempt to score. Adaptive behavior is pivotal in sports because conditions like the environment, task requirements, and motivations are highly dynamic and can change every time a person performs a skill (Davids et al., 2008). *Self-organization* is referred to as the spontaneous tendencies of complex adaptive systems to form patterns or synergies where system components adjust and adapt to changes in other parts of the system without the need for executive micromanagement of each component (Renshaw et al., 2019). Constraints influence and harness these tendencies for self-organization, which is imperative for sports coaches to understand. They can be purposefully manipulated in practice, facilitating an athlete's search for information (picked up directly through the sensory systems where there is no need for processing), leading to the potential for more skillful behavior to emerge (Gray, 2021; McKay et al., 2021; Silva et al., 2016; Williams et al., 1999). Conversely, while most agree that the search process is active (Anson et al., 2005; Gibson, 1979; Gray, 2021; Pacheco et al., 2019; Schmidt & Wrisberg, 2008; Turvey, 2018; Wagman, 2020; Yearby et al., 2022, 2024), the perception of information leading to the organization of movement is believed to occur differently in traditional approaches to skill acquisition. Here, an individual is thought to perceive a cue, which initiates the beginning of processing a response to it, whereby the individual goes through various stages of analysis before the end result, or output (action), is delivered (see Figure 2.1; Schmidt, 1975; Schmidt & Wrisberg, 2008).

Figure 2.1.

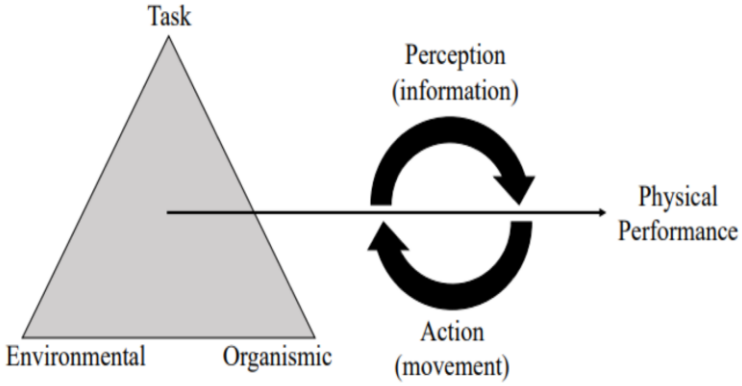
An Information Processing model to describe perception, decision-making, and action.

Inspired by Kugler et al. (1980) and Kugler et al. (1982), in 1986, Karl Newell, with an interest in understanding the development of infants and children, proposed the original constraints model, which sought to explain how coordination emerges from the interaction of constraints classified as the *organism (individual), environment, and task* (see Figure 2.2), which operate at varying time scales. Environmental constraints are physical or social in nature. Physical examples of environmental constraints include gravity, ambient light, humidity, temperature, and altitude, whereas social examples of environmental constraints include friends, family, spectators, coaches, social expectations, and

cultural norms (Chow et al., 2016; Glazier & Davids, 2009). Organismic (individual) constraints reflect personal properties like height, body weight, limb segment lengths, emotions, and perceptual and cognitive abilities. In 1995, Kelso argued that the most influential and prominent organismic constraint that shapes movement coordination is the learner's intentions. Finally, task constraints are more particular to the performance context; examples include game rules, equipment, playing area dimensions, boundaries, surfaces, opponents, and teammates (Davids et al., 2008). While it has been argued that task constraints operate in a hierarchy over environmental and organismic constraints (Clark, 1995), the continuous interactions between the individual, task, and environment channel the emergent patterns of coordination and, consequently, performance outcomes (Gray, 2021).

Figure 2.2.

Newell's (1986) model of interactive constraints. Adapted by Davids et al. (2003) to illustrate the resulting effects on variability of physical performance.



As previously mentioned, individuals moving within the world both provide and perceive information from the surrounding energy flows and have the capacity to utilize the available information they detect to interact with the

specified affordances (Gibson, 1979; Withagen et al., 2012). Through exploration of their environment, humans—in sport, athletes—can become more attuned to surrounding information, leading to dexterous behaviors characterized by functional solutions that emerge from self-organizing system components to satisfy the unique set of constraints interacting upon an individual performer at that moment in time (Araújo et al., 2019; Davids et al., 2015). For sports coaches and practitioners interested in ecological dynamics and applying a *constraints-led approach* (CLA), it is critical to understand what constraints on performance are, how they can interact together, operating at different system levels and varied timescales, and how they might be purposefully manipulated in practice to help athletes become more dexterous movers. Even with the growing literature advocating for the use of the CLA and other ecological ideas in practice (e.g., see McCosker et al., 2021; McKay et al., 2021; Morris et al., 2022; Myszka et al., 2023a; Yearby et al., 2022, 2024), others have challenged whether ecological dynamics and a CLA are even sufficient to guide effective talent development and coaching practice without considering the addition of other theoretical positions (Bobrownicki et al., 2023). Therefore, it is important that sports coaches and practitioners are well-informed about the differing theoretical frameworks that can support their practice. That said, given that the study aims to investigate the perceived impact on the professional work of sports coaches and practitioners after interacting with online learning material underpinned by ecological dynamics (such as Emergence), the application of the CLA and other nonlinear pedagogical ideas will be explored in Section 2.2.5. Prior to the section about the application of the CLA and other ideas related to NLP, affordances, which are unique to ecological dynamics, will be discussed. This will better assist readers with the ideas coaches are engaging with during the online education courses.

Additionally, they are an aspect of what is being investigated in this study, since when different constraints are manipulated by coaches, it may give rise to different affordances emerging on the landscape for athletes to interact with to achieve their goals. Therefore, to truly understand the impact sports coaches and practitioners perceive, it is critical to understand the intricacies of the ideas they are engaging with to inform their practice.

2.2.2. Affordances

The individual-environment relationship is at the heart of an ecological dynamics approach (Araújo & Davids, 2011) and is the appropriate scale of analysis for investigating the emergence of phenomena in sports, distinguished by the interacting constraints shaping behavior (Araújo et al., 2006). In order to investigate the emergence of any movement, the concept of affordances must be expanded beyond what has already been discussed. Researchers and theoreticians have indicated that they have the potential to become a guiding principle on perception and action in sports and are suitable to capture the behaviors of athletes on the playing field (Fajen et al., 2009).

Affordances were introduced by Gibson (1966, 1979), and according to his theory of direct perception, the environment offers potential opportunities for humans and animals to perceive and act upon in a surrounding landscape. Affordances imply that the environment in and of itself is meaningful, providing opportunities for action (Gibson, 1979; Reed, 1993; Withagen et al., 2012). Gibson elaborated, stating, "The meaning or value of a thing consists of what it affords" (Reed & Jones, 1982, p. 407). Affordances are proposed to be directly perceived by an individual within the environment; Gibson argued that there are patterns available in ambient energy arrays that specify affordances, implying that an organism (in our case, a player) can directly perceive them by interacting

with and picking up this information (Gibson, 1979; Withagen et al., 2012). Gibson (1979) went on to highlight that "affordances point both ways, to the environment and to the observer" (p. 129). Further, Gibson pointed out that affordances refer to both the environment and the animal in a way that no existing term does. Moreover, he elucidated that the word affordance implies the complementarity of the environment and the animal. From the ideas above, an important consideration for sports coaches and practitioners is designing representative practice activities that can help athletes select and use affordances that may emerge in gameplay to support their sporting actions (Button et al., 2020; Fajen et al., 2009; more on applying an ecological approach in Section 2.2.4 below).

The mutuality of the individual-environment relationship is captured nicely in this quote by Araújo and Davids, "In human behaviour, the act of ‘doing’ never occurs in a vacuum. To do is always to do something somewhere" (2009, p. 6). Affordances can, therefore, be viewed as the link connecting an individual to the world in which they move (see section 2.2.3 for more information). Consider how one might interact with objects, surfaces, and other people in our everyday world. For example, a chair guided by one’s intentions at that moment in time can be sit-on-able, stand-on-able, and so on. Additionally, this includes the team sport environment where gaps might afford (invite) *run-through-ability*, opponents might afford *tackle-ability*, or teammates might afford *pass-ability* (Yearby et al., 2022*)*. Affordances are perceived relative to an individual and guided by their intrinsic dynamics and effectivities (Turvey & Shaw, 1979). Intrinsic dynamics are the preferred states of a performer’s movement system, which capture their current available experience (Renshaw et al., 2019). Effectivities are the dispositional states or tendencies of the individual (Turvey, 1992) and include their specific movement capabilities, such as strength, power, and agility, as well

as cognitive, social, emotional, and psychological capabilities, all of which could enable them to move competently (Button et al., 2020). These together encompass the action capabilities of what an individual is capable of bringing to the performance environment, through the constant (re)arrangement of the system's DoF (i.e., perceptual, cognitive, and motor) into functional states of movement and behavioral organization. It is important for sports coaches and practitioners to understand that action capabilities are ever-changing (e.g., developing over time, aging, changing due to fatigue, injury toll, learning, and experience). Interacting constraints at any moment will structure and channel what an individual is capable of doing and how the system components can be arranged to actualize an affordance to accomplish one's goal (Esteves et al., 2011; Gray, 2021; Navarro et al., 2013).

For example, consider a basketball player who continually passes the ball to their teammates even when lanes are open in the paint, seemingly inviting a layup. Are they rejecting the affordance because they lack the confidence or skill to handle the ball in tight lanes with the potential of receiving contact in traffic? Are they fatigued and rejecting the affordance because it does not seem dribble-throughable at that moment, even though they are skilled in traffic? Or does it generally occur when the team is losing by a handful, nudging the player to pass for a 3-point shot? The point is that constraints (e.g., dribbling skills, other players, fatigue, and the score) continually shape and influence behavior. This key idea can be harnessed in practice by sports coaches and practitioners looking to design better learning environments leading to more skillful players.

Moreover, it is crucial to acknowledge that individuals are goal-directed, and intentions can support an individual searching the affordance landscape to accomplish their goal (Segundo-Ortin & Kalis, 2022). In 2012, Withagen et al.

expanded on Gibson's notion of affordances, stating they could *invite* behavior from individuals. These invitations are individual and frame-dependent and are based on their experiences and *knowledge of* the sport (Gibson, 1966). *Knowledge of* the environment means directly perceiving affordances that are present in it—an entanglement between an individual and their environment (Woods et al., 2021a). There is a distinction between knowledge of and what Gibson (1966) referred to as *knowledge about* the environment, which is *indirect*, a type of abstract knowledge, and often mediated through pictures, words, and symbols. This type of knowledge, for example, and specific to coaches applying ecological ideas in practice, could occur through communication with a player, which can be beneficial to support an athlete's knowledge of the environment. Affordances can invite, solicit, or beckon an athlete; ultimately, they can accept or reject the opportunity (Fajen et al., 2009; Withagen et al., 2017). The strength of the invitation can be increased by embedding athletes in *slices* of the sport (i.e., problems of varying complexity that look, feel, and behave like those found in the sport; Yearby et al., 2022), where constraints are purposefully manipulated that may give rise to affordances becoming available that learners can perceive and utilize to negotiate the affordance landscape (Rietveld & Kiverstein, 2014). The notion of affordances landscapes with invitations that emerge for athletes, helping them to solve movement problems, emphasizes the importance of representative and 'alive' learning environments where they can interact with opportunities and become more sensitive to them, leading to skillful behavior.

2.2.3. Affordances and Movement Problem-Solving in Sports

Affordances are functional relationships formed between an individual moving through a performance environment, not to be viewed as an entity or an object (Gibson, 1979). Therefore, affordances link the person and the

environment, and they have clear implications when discussing, analyzing, and facilitating movement problem-solving for athletes in sports. One of the most elaborate affordances of the environment is provided by other people, whose *"*behavior affords behavior*"* (Gibson, 1979, p. 135). This idea has great significance in the competitive arena where two or more individuals interact, giving rise to the emergence of different movement possibilities with the goal of successful sports performance.

For example, as an American football running back takes the handoff from the quarterback, they could have a myriad of affordances emerging and decaying on the affordance landscape. The gaps between the offensive linemen may afford run-through-ability, the space to the outside of the defensive ends may afford run-around-ability, teammates might afford pass-ability or serve as blockers, opponents may or may not afford run-over-ability, and so on. There is no ideal or optimal decision here for all performers to adopt; it depends. Context is everything in understanding the way that different individuals solve the same problems and challenges faced during competition.

The affordances within the landscape described above differ in relational strength and are dependent on the task, environmental, and individual constraints (effectivities) (Rietveld & Kiverstein, 2014). Affordance fields will emerge from the affordance landscape for a player based on their experience, action capabilities, intentions at the moment, and persisting task and environmental conditions. In the example above, the running back may be drawn to (invited to behave in a particular way) the affordance of bouncing the ball to the outside, where they can get into open space if their team is down by one score and time is running out; this is an example of constraints on behavior (see Section 2.2.5 for an example of how this might be guided by a coach). A critical question for coaches to ask

themselves is: Are athletes failing to actualize particular affordances in games because they are not available for pick up during practice? This means that affordances available in isolated drills differ from those that rapidly emerge and decay in dynamic sporting environments.

Gamespeed, or, in the example above, *American football speed* (Yearby et al., 2022), embraces individual (or athlete)-environment mutuality and a player's *knowledge of* the game*,* assisting them in perceiving and actualizing relevant affordances. The re-conceptualized notion of speed appreciates Kiverstein and Rietveld's (2015) idea of *skilled intentionality*, which they define as "the individual's selective openness and responsiveness to a rich landscape of affordances" (p. 701). This idea is important in contextual situations where players may become attuned to specific affordances that invite or solicit them in the affordance landscape, helping to increase their gamespeed and movement problem-solving abilities. Gamespeed is analogous to what social anthropologist Tim Ingold referred to as *enskilment*, or deep, tacit, and practical knowledge (Ingold, 2000; Woods et al., 2021b), where an individual gains implicit know-how that emerges as the player, in our case, becomes progressively attuned to and intimately familiar with the competitive performance environment. This type of knowledge, however, should not be confused with being proceduralized, where there is a storage of prescriptive rules in the mind for the automatization of movement (Woods et al., 2021b). Conversely, knowledge from this perspective views players as better equipped to detect information in the performance arena for use in regulating their behaviors. This point is pivotal for coaches and sports practitioners who are looking to learn more about designing learning environments that look, feel, and behave like the game, where players are

embedded in contextual situations and develop knowledge of their particular environment, providing a platform for adaptability (Yearby et al., 2022, 2024).

Sports are inherently complex and challenging contexts, offering highly variable movement problems for players to solve, and coaches are tasked with designing practice activities that players can interact with to improve their movement skill set (Yearby et al., 2022). Therefore, an important question to address is: How, then, might a coach help the players they work with solve more problems that emerge during gameplay? Bernstein (1967) defines the process of practice as *repetition without repetition*, in which players do not attempt to repeat the means of a solution to a motor problem over and over but rather the process of solving the problem with improved techniques that change from repetition to repetition. This means that coaches should look to embed athletes in 'alive' and representative learning environments (see section 2.2.5 for more detail) replete with opportunities for (inter)action (i.e., emerging affordances) that are near or slightly past their *optimal grip* on the field of affordances (Bruineberg & Rietveld, 2014), where they can search for functional fits to the changing problems they encounter. Moreover, constraints can be purposefully manipulated by coaches, giving rise to affordances that learners can perceive and utilize to better negotiate the environment (i.e., *constraining to afford*; Renshaw et al., 2019; Yearby et al., 2022). In doing so, players gain experience solving movement problems (varying in type and complexity) designed to meet individual learner needs that adequately challenge them, where they can adapt their skills in game-like situations. Through constraint manipulation in representative environments, coaches can help athletes deepen their knowledge of the game (O'Sullivan et al., 2021), increase their skilled intentionality, and ultimately help them expand their gamespeed and problem-solving abilities in sports.

In closing, a better understanding of affordance rejection and acceptance could assist coaches and athletes in the practice design and constraint manipulation processes, helping athletes become open and responsive to numerous affordances emerging on the landscape. Further, even though it is acknowledged that affordances emerge between an individual and the environment (Blau & Wagman, 2023; Gibson, 1979), it is not a stretch to ask if the athlete could have simply failed to pick up the affordance. This area has not been investigated in sports; however, it could be invaluable in understanding more about perceptual attunement, decision-making, and the complete movement problem-solving process. Additionally, with more research in this area, those working in different educational settings (e.g., nonformal education such as online coach education companies) might be better equipped to deliver material to help those interested in assisting their athletes solve more problems in sports. The next two sections are as important as the ones above to understand the complexities that exist when using ecological ideas within coaching. Time will be spent discussing the application of ecological ideas in practice, followed by what coaches might be able to do to remain sensitive and open to unfolding learning situations, whereby they might be able to facilitate better learning environments for the individuals they work with in practice.

2.2.4. Applying an Ecological Approach in Practice

A contemporary approach to skill acquisition places athlete-environment interactions at the core of practice task design to promote the development and enrichment of reciprocal functional relationships between performers and performance contexts (Button et al., 2020; Myszka et al., 2023a; Renshaw et al., 2019). This approach suggests that coaches assume the role of *activity designers* or *problem setters*, presenting athletes with ‘alive’ and representative tasks to

stretch their grip on the field of affordances so they can become more adept at solving movement problems that arise on game day. Therefore, there is a need to outline principles of NLP that can help coaches assist players in searching for individually relevant movement solutions.

2.2.5. Principles for Use in Learning Environment Design

The first principle to guide designers of practice (coaches and practitioners) is *representative learning design* (RLD). The origins of representative design began with the ideas of Egon Brunswik (1955, 1956), a psychologist who acknowledged the importance of organism-environment relations in experimental psychology. Brunswik specifically realized the significance of designing key features of the environment into experiments, so contextual informational sources were available to the participant (Renshaw et al., 2019). Representative learning design in sports (Pinder et al., 2011) suggests that practice design needs to reflect the constraints found in the competitive setting where the information available for pick-up is similar to the performance environment, so the emerging behaviors are game-like (i.e., they have action fidelity; Stoffregen et al., 2003). In representative environments, players can detect and use specifying information (e.g., the spin of the ball in court sports or the kinematics of a ball carrier in field sports) to softly assemble (Kugler & Turvey, 1987) integrated movement solutions that help effectively solve performance problems (Chow et al., 2016; Fajen et al., 2009; Myszka et al., 2023b).

To extend the RLD idea, Yearby et al. (2022) and then Myszka et al. (2023a) proposed the notion of *alive movement problems*, which implies that athletes should be engaged in activities that are dynamic, vary in complexity and intensity, and are replete with affordances. ‘Alive’ practice activities are vibrant, inviting athletes to engage with the world in an attentive way, thereby allowing for

emergent decision-making and flexibility within the coordinated movement solution. Embedded within ‘alive’ activities that are representative of the sport, athletes can continually search for an evolving "fit" to the problems they encounter in the ever-changing sporting environment.

The second principle to guide practitioners is *constraint manipulation*, or, as it is known in sports pedagogy, the constraints-led approach (CLA). Underpinned by ecological dynamics and NLP, the CLA can be purposefully used by coaches and practitioners to help athletes search for, discover, and exploit more functional movement solutions to the problems encountered in sports (Button et al., 2020). As discussed in the constraints section above, individual, environmental, and task constraints are tightly interwoven, shaping emergent behaviors. Coaches attempting to utilize a CLA in practice to help the athletes they partner with become more adept movers might try constraining to afford (Renshaw et al., 2019), where constraints are manipulated to illuminate potential affordances while channeling players toward their availability in the landscape. To clarify, practitioners are not designing affordances; rather, they are purposefully manipulating constraints that may give rise to affordances becoming available that learners can perceive and utilize to negotiate the environment, as affordances are formed between the athlete-environment system as an individual navigates through the sporting landscape.

For example, if through film analysis and in-person observation of a quarterback's behavior during the sessions it is identified that they need more contextual experience throwing intermediate and deep passes in the middle of the field, a task can be designed where the rules are manipulated, giving them two downs to move the ball 20 yards (instead of four downs to move the ball 10 yards). If successful, the offense maintains possession and continues the drive.

The playing field could be manipulated so that the width is reduced from 53 1/3 yards to the top of the numbers, resulting in a nearly 20-yard reduction in operational space. Further, the coach and the athlete can continually manipulate the numerical relations, creating advantages and disadvantages throughout the task (e.g., five versus four, three versus four), which changes the way the system components organize in the space available. It is worth mentioning that the quarterback would "own" the play selection, and they would not be limited to only using pass plays. Through sampling the sport in slices while ‘constraining to afford,’ they may be encouraged to search the landscape of affordances in an effort to exploit gaps in the defense, thus developing their position-specific *football speed*.

It is important to acknowledge that behavior affords behavior (Gibson, 1979), where the actions of opponents and teammates, in turn, influence the IMS organized to solve the emerging movement problem (Myszka et al., 2023b). Through constraint manipulation, the quarterback is therefore encouraged to search downfield, gaining experience throwing the ball with the changing spatiotemporal demands of both his teammates and the defense, where they might detect information inviting them to hit routes deeper in the secondary. Examples of a few other constraints that coaches can manipulate are the ball, the surface, the starting time of practice, the area of the field where the activities start, and the time remaining on the play clock, all of which require the athletes to coordinate their actions accordingly.

Players from the same team who are immersed together in problem-solving activities in practice can develop sensitivity to *shared affordances* (Silva et al., 2013). Picking up the affordances *of* and *for* teammates (and opponents) can aid in the formation of a communication platform that leads to greater success

in the performance arena, so coaches who work with athletes from the same team (even if it is just a few) have an even greater advantage. Inter-individual-environment synergies (i.e., emerging coordination tendencies between players or temporary couplings between players) can emerge under constraints as players are able to detect information and become sensitive to the behaviors of their teammates, serving to maintain functional integrity and leading to successful behaviors in competition (Araújo & Davids, 2016; Turvey, 2007). For example, when a running back in American football is carrying the ball in open space in a 2v1 situation with a teammate running in front of him in an attempt to block the defender, he might detect that the defender affords reach-ability by the lineman based on the relative velocity and bearing angle of his teammate in relation to the defender (Carvalho et al., 2014; Passos et al., 2008a, 2011). This information, coupled with the changing interpersonal distance between him, the lineman, and the defender, can specify that the lineman will reach the defender in time, inviting the running back to bounce the ball to the outside (Fajen et al., 2009). While there is more information that each player may be coupling their movements to as the play unfolds, exposure to situations similar to the one described above can help increase the perception and utilization of shared affordances—a crucial idea for coaches to consider in their practice design.

A key pillar in NLP is the need to develop relevant information-movement couplings in learning movement skills (Chow et al., 2006). Therefore, the third principle to guide practitioners is *task simplification*, which can be used to help promote effective skill acquisition from a NLP perspective (Chow, 2021; Chow et al., 2022). Task simplification allows learners to maintain the link between perception and action and support their search for specifying information, which can be directly perceived to regulate functional movement solutions (Chow et al.,

2016; Davids et al., 2008). Task simplification is important for coaches to understand and use rather than decomposing (i.e., breaking down) tasks into smaller parts, which could impact the coupling of information and movement and hinder learning and performance (Fajen et al., 2009; Panchuk et al., 2013; Renshaw et al., 2019).

In baseball, you will often see players hitting off a tee where the orientation and movement of the pitcher, including arm slot, release point, the ball's spin, and more, are not available for detection to guide the hitter's emerging movement solution. Coaches attempt to restrict the hitters even more by only having them execute part of the swing, which may or may not even include the bat. This is generally accompanied by copious amounts of instruction and feedback, where the coach tries to communicate with the hitter the correct model of swinging, all of which is constructed out of context.

When looking to assist players in developing functional information-movement couplings, it is critical they are embedded in practice tasks that are representative of the target sport. Otherwise, if players continually interact with drills that lack representativeness, they risk becoming attuned to perceptual variables that differ from those available in competitive contexts (Passos et al., 2008b; Pinder et al., 2011). Task simplification, which has clear relevance to constraint manipulation mentioned above, can be enacted in several ways. Coaches can design activities in the form of representative *slices of the game* (Yearby et al., 2022)—in this case, simplified ones—where the complexity of the problem meets individual needs. This can help increase attunement to the most relevant sources of information needed to maintain their goal-directed behaviors, leading to better decision-making during competition (Passos et al., 2008b).

An example of a smaller, less complex slice of the game is a one-versus-one activity designed to help a running back in American football work on their elusiveness. Rather than having them immersed in the full game or attempting to teach them cutting actions removed from context, a problem-solving space that is eight by eight yards could be set up with a clearly identified line to gain. The running back can explore different ways to beat the defensive player attempting to tackle them in this simplified version of the task. As the repetitions unfold, coaches might need to further manipulate constraints to assist the offensive player if they are struggling to win repetitions. For example, coaches might have the defender start with a greater distance from the ball carrier, or they might increase the size of the problem-solving area. Additionally, rather than hitting off the tee as described in the baseball example above, a coach could simplify the task of hitting a moving ball by having the pitcher reduce the velocity of the pitches they throw or have them throw only one type of pitch. Moreover, coaches could put a runner on, which puts more stress on most pitchers, likely making it easier on the hitter. The task could also be simplified by having the hitter practice during ideal weather conditions, such as on clear, bright days, which could make the in-flight ball information easier to pick up.

Other examples of task simplification include equipment manipulations, such as having individuals throw smaller balls (e.g., an American football), which might be easier to grip for youngsters who are learning to throw. Additionally, larger balls can be thrown to a young learner or one that has longer flight time, which can reduce the temporal and spatial difficulty without compromising the information-movement coupling (Chow et al., 2022). Lastly, a lighter bat with a larger barrel could be given to a young individual learning to hit a ball. It should also be recognized that coaches can communicate with athletes

during training sessions by educating their search in an attempt to help them detect information for use in organizing a functional movement solution (Woods et al., 2021c). More information on this will be provided in the paragraphs to follow. In conclusion, task simplification can help players increase their attunement to relevant information, assisting in the development of successful functional relations in specific performance contexts.

The fourth principle to understand that can help guide practitioners is *functional variability*. This idea links well with several others that have been discussed and include, but are not limited to, repetition without repetition and exploratory behavior. As previously stated, repetition without repetition of a task or activity is the process of solving a problem with improved techniques that change from repetition to repetition (Bernstein, 1967). This implies that the repetition of a movement will have variability in the emerging pattern as individuals look to authentically express themselves while solving problems in sports. Practitioners, especially those involved with martial arts, have understood this important idea for many years. Martial artist, actor, and philosopher of the 20th century, Bruce Lee, stated, “Set patterns, incapable of adaptability, of pliability, only offer a better cage. Truth is outside of all patterns” (Lee, 2011, p. 19).

Therefore, variability in movement is inherent and can be functional to allow a movement system to transition to new behavioral patterns and adjust between functional states of coordination (Button et al., 2020; Chow, 2021; Davids et al., 2003; Kelso, 2012). Variability in movement systems is linked to searching and exploring as a player looks to bring the DoF across the system (i.e., perceptual, cognitive, and motor) into relationship with one another to organize an integrated movement solution and become one with the problem

(Myszka et al., 2023a). Freedom of movement centralizes the athlete-environment relationship, as one connects to the world in their own unique way.

To influence movement variability in the form of the emerging movement solution, practice variability should be incorporated so individuals are challenged to explore different ways of solving movement problems (Chow et al., 2022). For example, coaches can manipulate task constraints, such as numerical relations, or the size of the playing space, which could promote the search and discovery of creative and functional movement solutions to solve the emerging problems. Furthermore, other task constraints, such as instructions or the equipment used (e.g., a ball with different tactile characteristics), could be altered to encourage learners to organize movement in different ways. It should be noted that too much variability in practice tasks might lead to random searching, which could give rise to non-functional behaviors emerging. Thus, purposeful constraint manipulation by a coach can help guide a player's search of the performance landscape, allowing them to detect information where movement system variability might be harnessed, leading to a functional solution emerging (Chow et al., 2008, 2022; Gray, 2021).

Finally, the *provision of informational constraints* (e.g., instructions and informative questions) can be used by coaches to guide exploratory behavior and influence how athletes aim to interact with tasks and what information they might look to pick up in practice and performance settings to help skillful movement emerge (Chow et al., 2009, 2016; Myszka et al., 2023a). The process by which an athlete may aim to interact with specific sporting problems (i.e., their intention) can be shaped by numerous factors, including but not limited to their needs and beliefs, as well as external influences such as instructions from a coach. For example, in a mixed martial arts (MMA) title fight, coaches might communicate to

a fighter that they are likely down three to one on the judges' scorecards, so they must look for an opportunity to finish their opponent in the last round. In turn, this can shape the pace at which the fighter intends to move, the levels they might manipulate to elicit openings (i.e., affordances) for the knockout, and so on.

Important to acknowledge in dynamic sports such as MMA is that intentions can change rapidly. A fighter moving laterally to elicit an opening from their opponent to deliver a knockout strike might see a jab coming, causing them to immediately pull their hands near their face in an attempt to parry the shot. Seeing this might cause the coaches to educate the fighter's intentions in other ways. For example, informed by what helped the fighter earlier in the fight, the coaches might yell, "Use your feints," which can educate the fighter's intentions and potentially support them in knocking out their opponent. Brief statements can also be used to encourage individuals to search for different ways of organizing their behavior in areas outside of sports. For example, in physical education settings, a teacher interested in assisting youngsters in exploring movement might set up a crash mat behind a plyometric box and say, "Show me how many different ways you can jump over the box." This subtle statement encourages the youngsters to attempt to run up at different speeds, try different maneuvers, and more, all leading to them searching for different ways they can orient their body (Rudd et al., 2021). Ultimately, as discussed in the constraints section above (2.2.1), intentions can frame how individuals attempt to couple their movement to specifying informational variables to become more adept movers.

Furthermore, coaches can help facilitate the process by which players find increasingly functional solutions to the problems they face in sports by utilizing guiding questions to educate their search for relevant information (Yearby et al., 2024). In American football, for example, a coach might encourage a defensive

back to see what behaviors they can detect in the upper body of a receiver as they are running deeper routes where the ball will have more flight time before it reaches them. The coach might go on to say, "What are their eyes doing when they turn to pick up the ball?" Further, he might ask, "What do the positioning and movement of their arms tell you about the future state of affairs (i.e., the arrival of the ball)?" These questions can illuminate the receiver's behaviors—eyes widening and arms extending in an attempt to make the catch—to inform the defensive back covering him that the ball is approaching. From an ecological perspective, it should be noted that by asking these questions, a coach expects the athlete to answer with their actions rather than a verbal answer.

In another example, if a midfielder in football (soccer) is struggling to find open teammates to advance the ball when being pressured by a defender in tight spaces, adjustments can be made to the design of the activity, where the spacing between defensive players in the middle of the field is increased, and coverage on the forwards near the boundary is tightened. In addition to the activity design manipulation, coaches might also ask a question to help the midfielder seek and exploit potential affordances. For example, the coach might ask, "What do you notice about the spacing between defensive players in the middle of the field?" By modifying the initial setup of the activity coupled with the question to guide the individuals search, the player might pick specifying information, such as interpersonal distance between the opposing team members in the middle of the field, affording or inviting them to actualize the space (Withagen et al., 2012, 2017). However, it is crucial that decisions to behave differently are still available (e.g., dribbling to beat defenders), even though the intentions of the task are to help players search for and find passing options under pressure.

It is critical to note that from a contemporary skill acquisition perspective, the primary goal is to help individuals expand their knowledge of the environment by guiding their attention toward relevant information sources and soliciting affordances so they can effectively organize their degrees of freedom to solve performance problems (Woods et al., 2020a). In conclusion, together, the pedagogical principles described in this section (2.2.5), which prioritize the athlete-environment relationship, the interacting constraints on behavior, and nonlinearity in learning, can greatly assist coaches interested in a contemporary approach to skill acquisition (Button et al., 2020; Chow et al., 2006, 2016, 2022).

2.3. Becoming More “Water-Like” As A Practitioner

“Empty your mind. Be formless, shapeless, like water. When you put water into a cup, it becomes the cup; When you put water into a bottle, it becomes the bottle; When you put water into a teapot, it becomes the teapot. Now water can flow—or it can crash. Be water, my friend” (Little, 1996, p. 43). Bruce Lee was a martial artist, actor, and philosopher of the 20th century whose ideas deeply align with an ecological dynamics approach to skill acquisition (Myszka et al., 2023a). The notion of adaptability captured in one of his most famous quotes above can help shape how coaches and other movement professionals approach their practice.

If skill is viewed as an adaptation process for athletes, then coaches must acknowledge the importance of continually adapting their skills and attempting to become more "water-like," remaining open and sensitive to changes they could make to assist athletes in their pursuit of dexterity. From an ecological perspective, coaches are conceptualized as part of a co-adaptive process (Orth et al., 2019; Woods et al., 2021c). The notion of co-adaptive relationships aligns with the thoughts of Lee (2011), who emphasized the importance of a teacher

never being a giver of truth; rather, they should be viewed as a guide, helping learners to discover for themselves. Again, these words from Lee emphasize the importance of a coach becoming more "water-like" in their interactions and through the application of the CLA. Coaches should ask themselves, "Am I designing practice activities for myself or the athletes I partner with in training?" Meaning: Do coaches have athletes drill a particular pattern that adheres to the model of movement they have identified as correct, or are they attempting to manipulate constraints that afford players opportunities to make decisions in contextual situations? Bruce Lee (2011) continually stated that all fixed patterns are incapable of adaptability or pliability, emphasizing that truth is outside of all fixed patterns. An ecological dynamics approach suggests that coaches should study the athlete-environment relationship to better understand emerging behaviors as one interacts with problems in the performance arena (Araújo & Davids, 2011; Davids et al., 2008; Strafford et al., 2018; Renshaw et al., 2019). In doing so, coaches are better equipped to design practice activities at or near the athlete's grip on the field of affordances (Bruineberg & Rietveld, 2014), where their skills continually evolve.

The art of coaching, notably when designing tasks that meet players where they are to stretch their grip on the field of affordances to help them become more adaptable in the competitive environment, takes time and is arguably arduous to master. One powerful way coaches might expedite the process is to "invite athletes to their own party" or embed them within the practice design and constraint manipulation process. The notion of representative co-design (Woods et al., 2021c; Yearby et al., 2022) attempts to capture the athlete's knowledge of the performance environment, where activities are designed that expand on their strengths or target their movement problem-solving weaknesses (i.e.,

opportunities for improvement). While there is limited research on an athlete's involvement in activity design and constraint manipulation alongside the coach (e.g., see Woods et al., 2021c; Yearby et al., 2022), it seems logical to include them in the discussion given that "affordances are neither in the animal nor in the environment but emerge only in the relationship between the two" (Blau & Wagman, 2023; p. 75). One way coaches could attempt to involve players within a training session to capitalize on their experiences is to ask, "How would you increase or decrease the complexity of the current activity to provide an appropriate challenge?" It could be argued that the timeliness of the question depends on what the coach is picking up from the player's behavior (both during the session and across sessions). Are they seamlessly solving problems (e.g., completing passes, making shots), which may indicate the problems are too easy, or is it noticeably complex, resulting in non-functional solutions continually emerging (i.e., they are not solving problems)? While the answer will vary depending on the individual and situation, asking athletes questions can engender feelings of involvement (potentially leading to increased self-esteem and confidence) and assist coaches when manipulating (or co-manipulating) practice tasks to help meet individual learner needs (Chow et al., 2022; Orth et al., 2019).

In his personal interpretation of martial arts (Jeet Kune Do), Bruce Lee emphasized the concept of using *no way as way* (Lee, 2011). This powerful idea can be embraced by coaches in an attempt to become more water-like in their practice. According to Myszka et al. (2023a), coaches and sports practitioners could seek out relevant ideas or approaches from other disciplines and apply them in their practice to help the athletes they work with solve more problems in the competitive arena by organizing varying techniques (ones that are

functionally fit for solving the problem). For example, a youth basketball coach who studies MMA might notice the various feints used by fighters to elicit behaviors from their opponents. In turn, this might lead to them communicating with the younger athletes they partner with by nudging them to search for ways to move deceptively (e.g., head or ball fakes) to see if it opens more dribbling or passing lanes.

Another way to embrace water-like qualities as a coach (Lee, 2011; Myszka et al., 2023a) is to look for opportunities to communicate with players in ways that resonate with them based on their experiences. Coaches must ask themselves: Do I script my communication so that I say the same thing to everyone? Based on a player's "form of life," described by philosopher Ludwig Wittgenstein (1953) as the behaviors, skills, capacities, attitudes, and beliefs, a player is sure to connect with feedback and guidance in different ways. In some situations, a simple question may suffice to help educate their intention and attention (Button et al., 2020; Gray, 2021; Myszka et al., 2023a; Woods et al., 2021c), whereas a younger player or one who has recently moved to a new area may need more explanation or explicit guidance. Next, literature from the second pillar of the research project will be reviewed, exploring how the material from ecological dynamics highlighted here could be integrated into online learning opportunities for coaches.

2.4. How Do Coaches Learn? Formal, Nonformal and Informal Learning

There are numerous ways in which one can immerse themselves to gain a deeper understanding of a specific area of interest and apply the information in a meaningful way in practice. *Formal*, *nonformal*, and *informal* learning opportunities are used to categorize the types of experiences in which one learns

(Coombs & Ahmed, 1974; Nelson et al., 2006). Traditionally, coaches have been educated in some countries by national sporting organizations and governing bodies of sport (national and international federations); in others, coaching has typically been the authority of the higher education sector (universities, colleges, and specialist sport education institutes). In most countries, a mixed model operates through which a variety of organizations at different levels of the educational pathway offer various opportunities for coaches to be educated and developed (Lara-Bercial & Mallett, 2016).

Formal learning is defined as something that takes place in an "institutionalized, chronologically graded and hierarchically structured educational system" (Coombs & Ahmed, p. 8). Along with formal education opportunities such as universities, other activities conforming to this definition include large-scale coach certification programs developed by the national governing bodies (NGB). In one study evaluating coaches' perceptions of Canada's National Coaching Certification Program (NCCP), a large majority of the 285 participants (95%) stated that the course either met (68%) or exceeded (27%) their expectations (Misener & Danylchuk, 2009), which speaks highly of the content and its delivery. While there is undoubtedly benefit from these large-scale, highly structured, and more generalized learning opportunities, formal opportunities have also been accompanied by critique (Mesquita et al., 2014; Nelson et al., 2006). Specific to sports coaching, critics noted that the coaching information was delivered in a very standardized format where the material could be acquired and implemented in a mechanistic manner (Nelson et al., 2006).

In a study conducted in Portugal, which consisted of six top-level coaches from different sports, including volleyball, gymnastics, swimming, handball, and basketball, participants voiced a certain amount of dissatisfaction with the coach

education framework used, stating it is "a very didactic and classroom-orientated framework detached from the coaching reality" (Mesquita et al., 2014, p. 127). Many countries approach professional coach education programs didactically, where information is "delivered" rather than the teacher and students "entering into" a conversation where there is a mutual exchange and the teacher can meet students where they are. When educators “enter into" a conversation, they can create a more engaging and interactive learning experience for their students, arguably leading to better retention and application of the concepts being taught. This approach also allows for more personalized and tailored instruction, as educators can adapt to the specific needs and interests of individuals within their audience. The coaches added that it was essential to choose what they wanted to learn and how, where informal mentoring, observing other coaches, reading books or papers, watching videos, and using the internet were referred to as “homework” (p. 131), which they reiterated was highly important for their growth process (Mesquita et al., 2014). They particularly valued “communities of practice” (CoP), classified as an informal learning opportunity that I will discuss later, valuing the importance of interacting with other coaches.

Additionally, formal education from a NGB was also critiqued by coaches, who stated that they frequently leave with an understanding of sports sciences (e.g., physiology, psychology, and biomechanics), as well as tactical and technical knowledge of their sport, but little understanding of the pedagogical and socio-cultural aspects of the coach's role in the coaching process (Cassidy et al., 2004; Nelson et al., 2006). It was also noted that there is often minimal follow-up and limited opportunities to integrate the new knowledge into practice (Knowles et al., 2001). While it is essential to gain a deep understanding of sports sciences, limited exposure to applying the knowledge, methods, and applications in

practice with players of varying ages, genders, ethnic backgrounds, and experience levels creates a "gap" in the theory-practice link, resulting in sub-par coaching practice. From the dissatisfaction shared above, it seems as though offering students a variety of choices and opportunities to interact with their peers and instructors can enhance their engagement and motivation, leading to a more meaningful and effective learning experience. Even in formal settings such as universities, it is critical to attempt to improve the delivery of material to help advance knowledge and practice that avoids taking an approach set out to convince students there is a ‘right way’ of thinking and behaving (Nelson et al., 2006; Rogers, 2002).

Nonformal learning opportunities are conceptualized as, "any organized, systematic, educational activity carried on outside the framework of the formal system to provide select types of learning to particular subgroups in the population" (Coombs & Ahmed, 1974, p. 8). Nonformal learning opportunities include, but are not limited to, coaching conferences, seminars, workshops, and clinics. Nonformal learning shares many characteristics with formal learning opportunities; however, it differs as it presents specific subgroups of a population (e.g., high-performance coaches, physical education teachers) with alternative sources of learning (e.g., short courses delivered on a specific area of interest) (Nelson et al., 2006). Nonformal learning, such as clinics and websites, was selected by coaches at Canadian Interuniversity Sports as the best way that sports science information could be delivered (Reade et al., 2008), suggesting that there is value in nonformal learning opportunities and their ability to target specific areas of interest. Further, this indicates the need for research to assess the impact on the professional work of sports coaches and practitioners after engaging with such material. In doing so, and with the findings, those in charge

of education development might be able to model the delivery to ensure pedagogical abilities are improving.

Combs and Ahmed (1974) define *informal* learning as, “the lifelong process by which every person acquires and accumulates knowledge, skills, attitudes, and insights from daily experiences and exposure to the environment.” This lifelong learning journey occurs through previous experience as an athlete, mentoring, coaching experience, and interactions with peer coaches and athletes (Cushion et al., 2003; Irwin et al., 2004; Jones et al., 2004; Nelson et al., 2006). Moreover, informal learning can be thought of as self-directed learning that also occurs when coaches explore the internet, read journal articles or books, watch sports science videos, or observe the performance of athletes (Irwin et al., 2004; Nelson et al., 2006; Schempp et al., 1998).

“Informal learning networks” (Brookfield, 1983, p. 53) or "CoP" (Lave & Wenger, 1991, p. 29) are one of several self-directed learning opportunities. CoP are groups of like-minded individuals who unite to exchange information and ideas, where they can lean on and utilize each other's accumulated pool of knowledge and experience to provide solutions to practical dilemmas (Brookfield, 1986; Nelson et al., 2006). In the context of coaching, it is suggested that through these informal learning networks, collective understandings emerge and shared meanings about the occupational culture of coaching start to take shape (Cushion et al., 2003). It is critical to investigate how nonformal and informal learning opportunities (where far more time is spent compared to formal learning) impact coaches because such formative experiences carry far into a coach’s career and provide a continuing influence over perspectives, beliefs, and behaviors (Jones et al., 2004). Additionally, there is significant value in learning more about the

interaction and impact of blended nonformal and informal learning on professional coach development (Walker et al., 2018).

2.5. Coach Learning Opportunities: The Growing Need and Desire for Online Professional Development

Various fields, such as physical education and sports, have seen the internet as a valuable source for learning (Blumenstein et al., 2012; Davis, 1998; Kirk et al., 2006; Pope et al., 2015). Moreover, with the increasing accessibility of coach learning opportunities online, sports policymakers and coach educators must understand how the internet can be better utilized as a learning source to enhance coaching knowledge (Koh et al., 2017). Studies have revealed the internet (which includes access to pay-for and free education courses) is favored as a learning source for coaches due to its easy and flexible accessibility, time-saving features, low cost, and affordance of new ideas (Koh et al., 2017; Pope et al., 2015). Furthermore, in 2016, Sackey-Addo and Pérez stated, "In the case of the Royal Federación Española de Tenis (RFET), it was identified that one of the main reasons coaches do not attend educational events is the lack of time and economic resources" (p. 31). In another study, 67% of responding coaches felt they would be more likely to pursue further education if it were offered online (Vargas-Tonsing, 2007). In a study by Kubayi et al. (2016), coaches said they too would be interested in online education if the topics were relevant and if the courses were in line with their league‘s requirements. This information, taken together, illuminates the value coaches and practitioners place on online learning opportunities to increase their professional knowledge, which helps impact the individuals they work with in their learning environments.

2.5.1. Understanding More About the Impact Coaches Perceive From Online Learning Opportunities

From the literature above, it is apparent that there is a desire for online coaching education. Recent studies (see Buchner & Plessl, 2022; Driska, 2018; Koh et al., 2017; Sackey-Addo & Pérez, 2016; Santos et al., 2019) have suggested that coaches have positive experiences from engaging with online learning material, both from searching the internet and taking coach education courses. Koh et al. (2017), who interviewed ten youth-level head soccer coaches working throughout Singapore, stated that "all the participant coaches affirmed many benefits of the Internet in assisting them to acquire coaching knowledge" (p. 281). The coaches emphasized that the main reason for using the internet (categorized as informal learning) was the accessibility of "coaching ideas," specifically, drills, strategies, and coaching plans. While the feedback was largely positive, it was also acknowledged that having control over what they would like to learn and the pace of learning could compromise the quality as it is unguided, with one coach stating that "random browsing" (p. 283) was used as a strategy to locate coaching resources. Other studies (Pope et al., 2015) mentioned similar limitations of online learning from the internet, with participants saying there can be "information overload," making it difficult to use the internet as an effective learning source. Self-guided learning has its benefits, but using a random browsing strategy is limiting for learners because they may be restricted by what they are familiar with, which could limit their growth and be “time consuming for coaches who do not have a lot of free time” (Wright et al., 2007, p. 139). Additionally, Pope et al. (2015) noted there was a need for more experienced or knowledgeable coaches, who may encounter fewer barriers to gaining access to helpful educational material because of their specific expertise in an area of

study. Furthermore, coaches have reported they preferred the interactive and engaging nature of the internet versus traditional learning opportunities (e.g., books and journal articles), with additional comments about the flexibility of pausing, rewinding, and the ability to continually engage with the videos (Koh et al., 2017). Moreover, coaches have expressed value in learning from and interacting with others where there is a wider vision of the coaching process, especially when embarking on their coaching careers (Mesquita et al., 2014). Coaches in other studies have expressed similar interests in interactive courses where they could converse about the information shared by instructors and other participants, potentially bringing great utility to the ideas, which can positively shape practice (Santos et al., 2019). Unfortunately, however, discussion amongst course participants and instructors is not always a possibility and is rarely offered by those who create online learning opportunities for sports coaches and practitioners (see Emergence for an exception), with most NGBs and companies recording content and selling courses where individuals engage with the material without any interaction with instructors or other participants. Therefore, a gap in the literature that needs to be addressed is studying companies or others presenting online learning opportunities that offer both recorded content and an interactive experience where there is dialogue around the content material.

Similar to Koh and colleagues, after evaluation, Driska (2018) found coaches had positive experiences with the USA's national swimming online program (categorized as formal learning). Nearly every coach in the study found something useful from the course, with the most commonly reported themes being teaching skills, drills, and proper pedagogy. Of interest in the study were the effects on coaching behavior—many coaches indicated that their practice design and coaching knowledge were influenced—a positive acknowledgment

when linking theory to practice. While coaches self-reported the adoption of specific knowledge and behaviors, the author acknowledges that after probing, it was difficult to obtain specific examples from coaches to support claims of change with evidence related to the course (Driska, 2018). More research needs to be conducted in this area, prioritizing participant experiences *after applying* the ideas in practice to understand more about the value and impact they perceive from engaging with the course material. Moreover, a majority emphasized “some form of goal-setting or reinforcement process with their athletes, indicating “that the course had introduced the behavior or reinforced an existing practice” (p. 266). While most perceptions of the USA's national swimming online study were positive, participants shared their frustrations about retrieving the material after completing the course because their credentials had expired and expressed interest in seeing more teaching progressions.

In a recent study, Buchner and Plessl (2022) conducted synchronous face-to-face meetings using web conferencing software and incorporated asynchronous learning phases through a learning platform to measure skill acquisition. Importantly, and in line with other studies (Driska, 2018; Koh et al., 2017), the results also showed the participants were very satisfied with the course and found it helpful to their practice. Participant attitudes toward the learning design were also positive. Results from the online course (categorized as nonformal learning) aimed at helping volleyball coaches better identify "the ideal movement sequences" (p. 233) and "see and correct movement executions" (p. 237) indicated that the learning design was effective in the facilitation of one of the main skills volleyball coaches need. However, while this is a positive finding, the comments mentioned above and the *Tell-Show-Do* model used in the study assume that there is one "ideal" technique that all learners should adhere to, with

little to no mention of the context in which the movements "to be corrected" emerged. Whether this is the best pedagogical approach or not, this elucidates a major gap in the literature: the paucity of research investigating coaches' experiences after engaging with online education material underpinned by an ecological approach to skill acquisition in sports. Overall, while there was some criticism, the experiences were primarily positive across the studies that were analyzed. Through analysis of the literature, four noticeable gaps were identified, some of which were addressed briefly above. In the following paragraphs, they will be unpacked to bring greater clarity to areas that need to be expanded to advance practice.

The first gap in the literature above is the lack of diversity among the participants included in the studies. Most of the studies generally investigated coaches from a single sport, with a majority also including participants from the same countries (Buchner & Plessl, 2022; Driska, 2018; Koh et al., 2017; Santos et al., 2019). Additionally, most of them had similar levels of experience and qualifications. My critique is not about the focus of the studies; rather, it is to highlight the need for research in this area to include a broader participant group. In my research, I hope to include coaches and sports practitioners (both novice and experienced) from numerous countries with varying ethnic backgrounds, as well as those who coach different positions at varying levels, all to gain a better understanding of how education affects a broader range of participants.

The second gap in the literature—briefly mentioned above—is the impact the online learning material has on the practice of coaches and practitioners, or, more specifically, their perceived strengths and limitations in applying the ideas after interacting with the educational material. The 2017 study by Koh et al. sought to investigate the perceived benefits of using coaching resources from the

internet, the types of resources pursued by youth soccer coaches, and how the information is used to improve their coaching knowledge. Investigating what resources impact their coaching knowledge is valuable, but the "acquired" knowledge is only relevant if we glean more from their experience applying the learned ideas in practice, thus creating a theory-practice link. Questions assessing the perceived impact in practice *after* applying the ideas they interacted with will reveal more about their coaching knowledge. One of the research questions guiding the Koh et al. (2017) study was, "How do they use the Internet resources to support their coaching?" While an important question, the results were limited. Coaches shared that they would memorize what they saw on the internet and try it in their practice or choose drills and tactics to apply in their training. In the "Limitations and future research directions" section, the authors acknowledge the gap by stating that "the quality of learning and effectiveness of the application of such learning to coaching practice is unknown" (p. 287). Therefore, this illustrates the importance of research to learn more about the experiences coaches have, including the strengths and weaknesses they perceive after applying the ideas in their professional work. A two-phase study with a survey and semi-structured interviews would allow researchers to explore the application of the ideas in greater depth.

A single study was identified where the author (Driska, 2018) focused part of their research on evaluating the effectiveness, with one of the key topics of interest being "specific knowledge learned from the course and how coaches implemented this knowledge in their work" (i.e., the link between education and behavior). Of the 21 coaches in the study, 20 reported that they learned something useful from the course, with the most commonly reported themes being teaching skills, drills, and proper pedagogy. The participants added that the

modeling of skills and drills was useful, with several coaches suggesting that it would be helpful to see more teaching progressions beyond those shown in the course. However, while this is a positive step in the right direction in learning the impact on practice, the takeaways from the participants' experiences shared above do not tell us much about the strengths and limitations they perceived after applying the knowledge "gained" from the course.

The third gap in the literature is the paucity of research investigating the confidence level of coaches after interacting with online education material, whether from nonformal education courses targeted toward a specific population group or informal education sources, such as browsing the internet or watching online videos. It could be argued that coaches are better prepared to design and facilitate learning environments for the players with whom they work when they have more confidence in their abilities, especially when using an ecological approach that requires them to actively engage in manipulating constraints within practice that embeds athletes in 'alive movement problems' scaled to meet their needs (Chow et al., 2016; Renshaw et al., 2019). One of the few attempts to investigate the confidence level of coaches after engaging with online education was conducted by Driska (2018); one coach stated: "[The course] reassured me in my coaching ability... after I took it... I packed it up nice and neat, and just said, like, okay I know that now... I've been reaffirmed... I knew my stuff in that course... I'm on a good path." I learned new drills, like I said, but as a whole, I think it was mostly like... reassuring me that... I've been using the right drills, the right techniques... I was confident in my coaching after I finished it." (p. 265). Feedback like this is valuable; therefore, more research is essential in this area to support those designing education to assist coaches.

Finally, as briefly discussed above, the fourth and largest gap is the dearth of research investigating coaches' experiences after engaging with online education material underpinned by an ecological approach to skill acquisition in sports, as outlined in the first part of the introductory review. The research has primarily focused on the perceived value of interacting with specific learning pathways (e.g., informal internet searching and nonformal courses targeting particular subgroups of the population) without mentioning the theory that supported the development of the content the participants interacted with in an attempt to improve their practice. Therefore, with a growing number of sports coaches and practitioners adopting a contemporary approach to skill acquisition, research investigating the impact they perceive from online education supported by ecological dynamics is critical.

2.6. Conclusion

Even though there is limited research available, specifically work assessing the impact of online education on the professional work of sports coaches and practitioners *after* applying the ideas learned from material such as formal and nonformal courses, watching sports science videos, etc., the studies above highlight the value perceived by coaches and other movement professionals after engaging in online professional development. Therefore, it is important to continue exploring the effectiveness of online coach education—especially content underpinned by ecological dynamics—and develop evidence-based strategies for delivering high-quality online professional development opportunities. This contemporary effort can help coaches, skill acquisition specialists, and other movement professionals enhance their knowledge and skills, ultimately benefiting the athletes they work with.

Chapter 3: Methodology

3. Introduction

The principal research aim of this study was to investigate the perceived impact on the professional work of sports coaches and practitioners after interacting with and applying ideas learned from online learning material underpinned by ecological dynamics. With the focus on the theory-practice link, the objectives were to: a) examine the strengths and limitations participants perceived in their coaching after applying ecological ideas in practice; b) investigate the extent to which the online learning material impacted their understanding and confidence when applying the ideas in their practice; and c) investigate how the online learning material may have helped them or not in their professional practice. To investigate the meaningfulness of the applied ideas, I employed a mixed-methods approach, implementing a survey with both closed- and open-ended questions (the first stage of the study), followed by semi-structured interviews conducted online with a sub-sample of participants (the second stage), drawing upon the strengths of each method to address my research question (Morgan, 2007; Queirós et al., 2017). The online survey and interviews were largely oriented toward understanding the participants' lived experiences after applying ecological ideas in practice versus what they knew about ecological dynamics by taking a test—or, written another way, I wanted to learn more about the impact they perceived after "putting their knowledge to use in practice" (critical for a professional doctorate) in an authentic and meaningful way (Gibson, 2017; Hesse-Biber, 2010).

The data collected and analyzed between the two stages complemented one another and provided windows to look into the professional practices of sports coaches and practitioners in different ways. These methodologies helped me to learn a great deal, which made it much easier to evaluate my research

question because I was able to explore the connections and contradictions between the quantitative and qualitative data (Gibson, 2017; Shorten & Smith, 2017). Additionally, using different methods (i.e., a survey and a semi-structured interview) to collect and analyze data about the perceived impact the online learning material had on the participants' professional practice helped to strengthen the findings by complementing one another and telling an in-depth story about the data (Burke, 2017; Gibson, 2017).

In the following sections, I will expand on the details of my research design, including more information about the reasoning behind using a mixed-methods approach and how the data were collected and analyzed. To conclude the chapter, I will explain the steps taken to ensure research quality and rigor, including ethical considerations, and offer insight into directions for future research.

3.1. Research Design

To inform the research paradigm used, it is crucial to take the researcher's philosophical viewpoints into account when conducting scientific inquiry. A research paradigm is a fundamental viewpoint that directs scientific inquiry, according to Guba and Lincoln (1994), with ontology and epistemology being the two components that underpin all philosophical positions. Assumptions regarding the nature of reality are known as ontologies, while beliefs about how we learn and understand the world are known as epistemologies (Kaushik & Walsh, 2019). An important aim of my research was to understand how the ideas covered in the online education material were applied in practice. Therefore, to address the research aims, I adopted a pragmatic research paradigm (Creswell & Creswell, 2022), which places a strong emphasis on research procedures that are guided

by the research question and result in findings that are applicable and useful (Onwuegbuzie & Leech, 2005).

In adopting a pragmatic paradigm, I was able to glean more from the participants about the strengths, limitations, and overall impact they perceived after interacting with the online learning material underpinned by ecological dynamics and applying the ideas within their professional setting. Furthermore, through pragmatism, the research aim was placed centrally, emphasizing shared meaning-making and transferability to examine the applicability of the research findings to advance understanding of applied practice in sports (Morgan, 2007; Shannon-Baker, 2016).

The mixed-methods approach that was chosen for this study helped to capture a panoramic view of the participants' perceptions (Creswell, 1999; Gibson, 2017) to better understand the impact that the sports coaches and practitioners perceived after applying the ideas they interacted with in the online courses. Mixed-methods research, which has increasingly been used in the past two decades within sport and exercise contexts (Moran et al., 2011; Ryba et al., 2020), is defined as research where qualitative and quantitative approaches are used in a single line of inquiry, integrating the findings and drawing conclusions using both types of data (Tashakkori & Creswell, 2007).

The following five pillars that define mixed-methods research established by the American Psychological Association (APA) served as the foundation guiding me throughout this project: "(a) collecting and analyzing both qualitative and quantitative data in response to overarching research aims, questions, and hypotheses; (b) using rigorous methods for both qualitative and quantitative research; (c) integrating or "mixing" the two forms of data intentionally to generate new insights; (d) framing the methodology with distinct forms of research designs

or procedures; and (e) using philosophical assumptions or theoretical models to inform the designs" (Levitt et al., 2018, p. 40). Due to its goal of bridging the gap between qualitative and quantitative research methods, mixed-methods research is frequently referred to as "the third research paradigm" and aims to combine necessary aspects of both quantitative and qualitative research positions, such as using empirical data and reducing confirmation bias (Johnson & Onwuegbuzie, 2004). This outcome is vitally important to this project as I am the co-founder and co-director of education at Emergence, the company where participants engaged in online learning (see section 3.4: Research Quality and Rigor for more information).

Important to the coherence of the study was the order of development, which was done sequentially, starting with the survey (first stage), followed by semi-structured interviews (second stage). By implementing the survey, I was able to collect quantitative and qualitative data through the use of closed- and open-ended questions. Likert scale questions were used alongside the open-ended questions as an objective way to capture the thoughts and experiences of participants quickly (Nemoto & Beglar, 2014) and increase the possibility of a high response rate. This approach eliminated the need for them to provide a lengthy response to every question while still providing an option for them to voice their experiences, especially if these were hard to capture in words. Additionally, the quantitative data collected on the Likert scale questions helped to provide patterns in observations, reducing the likelihood of any bias while assisting me in gathering numerical data points about a broader group of participants to support the qualitative findings (Creswell & Creswell, 2022).

After collecting and analyzing the quantifiable data (see section 3.3 for more detail), I was able to harness the power of qualitative research by reading

and examining the explicit responses of the participants, followed by deeper analysis where latent thoughts were discovered. Doing so allowed me to learn even more about their experiences applying the ideas in their professional practice (Braun & Clarke, 2012; Denzin & Lincoln, 2011). While maintaining reflexivity (such as exercising objectivity and openness in my analysis), which perpetuated throughout the study (Olmos-Vega et al., 2023), I went as far as developing candidate themes in my analysis, which informed me how I could ask better questions during the semi-structured interviews to gather more in-depth accounts of their personal experiences, ranging from strengths to weaknesses (opportunities for improvement) they perceived in their coaching (Braun et al., 2017; Smith & Sparkes, 2017).

Next, to support the survey data, semi-structured interviews were conducted with several participants, asking them to expand on the information they shared to further investigate their perceptions while applying the online ideas in practice. This helped me to glean more about the interconnections between the two stages and provided me with a deeper understanding of their rich experiences as the data was analyzed (Anguera et al., 2018; Bazeley, 2012, 2015; Griffin & Phoenix, 1994; Newman et al., 2015). After collecting data from the survey and semi-structured interviews and after some initial analysis in both stages, the data sets were amalgamated before the completion of the analysis. Consequently, employing a mixed-methods approach allowed me to address my research question more definitively than a qualitative or quantitative approach used alone (Bazeley, 2009; Bazeley & Kemp, 2012; Creswell & Plano Clark, 2011; Gibson, 2017; Teddlie & Tashakkori, 2009). In the following sections, after outlining the participant sampling strategy, the data collection and analysis methods will be addressed in detail.

3.1.1. Participant Sampling Strategy

Purposeful sampling and information power were used to inform my participant selection. The concept of information power, defined as the power the sample holds, which considers items such as sample specificity, quality of dialogue, and others, was used to inform my sample size (Malterud, 2001; Malterud et al., 2016). Using the Emergence student database, 203 participants were selected for the online survey using the following inclusion criteria: 1) the type of learning opportunity that they had engaged in, and 2) relevant demographic considerations. The type of learning opportunity that they engaged with was important because Emergence offers a range of options (categorized as nonformal learning opportunities), some of which are practically driven with theory supporting them throughout, while others are highly theoretical with practical examples offered throughout. Moreover, Emergence offers video-recorded courses with little or no interaction with the educators, as well as interactive opportunities such as The Movement Academy (TMA), allowing for a deeper, more personalized experience. TMA includes 12 (1-hour+) individual calls with the student (discussing theory and its application) and six exclusive cohort calls (generally a group of three to ten) to bring the participants together to create a community through rich discussion. Other interactive options include consulting calls and the Sport Movement Skill Conference (SMSC), which is an annual event with presentations (including time for Q&A) from experts in movement and skill acquisition from around the world.

To be considered for participation in this study, students had to have engaged with larger, more comprehensive offerings discussing a combination of theory and practical application (e.g., Underpinnings, any SMSC purchase, or any edition of TMA; please see Emergentmvmt.com and click “View our courses”

for all learning opportunity descriptions), or they had to have engaged with two smaller courses containing both theoretical and practical components (e.g., Reconceptualizing the Warm-up and Ecological Dynamics for Dummies), collectively exposing the participant to enough material where there was a similarity between experiences—this was the main criteria that narrowed the sample from nearly 1,000 to 203 participants.

It is worth mentioning that all the educational offerings from Emergence include complimentary access to Movement Meet-Up (MMU) calls (an informal learning opportunity hosted virtually), which run periodically throughout the year and serve as a platform for discussion and professional growth for all. While it is unclear how many participants were involved (it is not a requirement), the MMUs are generally well-attended by students. The MMUs offer a platform for participants to converse with other interested parties and those who deliver the online learning material. The student's geographic location and occupation also served as critical factors that were considered during participant selection. These were important to capture greater diversity; therefore, demographic characteristics, coupled with the types of courses the students interacted with, informed the participant selection.

Of the 203 participants, 47 completed the survey, equaling a response rate of 23.15%. Other studies investigating online surveys (also called internet-based or web-based) response rates found 17% for the "long" version, which took 30–45 minutes to finish (Deutskens et al., 2004), and 36.29% in another study (Ebert et al., 2018). It is critical to acknowledge that numerous factors influence the response rate (e.g., incentives offered and the detail required to formulate quality responses). No incentives were offered in this study, and the types of questions asked invited detailed responses, which undoubtedly impacted response rates.

Furthermore, in the survey invitation email (see Appendix 3.1), I informed the potential participants that it would likely take between 25 and 45 minutes, depending on the details provided during the open-ended questions. This likely influenced the response rates; my goal was to be transparent so that quality responses were offered.

3.1.2. Semi-Structured Interview Sampling Strategy

Of the 47 participants who completed the survey, seven accepted invitations to be included in the semi-structured interviews, ensuring diversity by including sports coaches and practitioners who occupy different positions in organizations, have different experiences, live in various geographical locations, and coach players (or patients) of different age groups and experience levels. Culture and experience can influence the behavior of both coaches and athletes, so it was important that individuals from numerous countries (or regions within countries) who occupied different roles and coached different sports were included in the semi-structured interviews to examine if the experiences were similar across populations (Button et al., 2020; Davids et al., 2008; Yan & McCullagh, 2004). It is important to note that of the 47 participants who completed the survey out of the 203 invited, of whom several were female, only one completed the survey and mentioned that they had only gone through limited portions of the online courses, not because of a lack of interest but because they had been busy coaching. Because of this, they did not participate in the semi-structured interviews.

In addition to the reasons mentioned above, the seven participants were included based on the depth of their survey responses, allowing follow-up, and the courses they had taken (participants were included if they had taken more than one in-depth course, e.g., Underpinnings and The Movement Academy, or

if they had taken one in-depth course and one or more practically driven mini-courses, such as the "Agility" course). Below is a list of the selected participants, along with the countries where they live, their experience, and the population and primary age of the individuals they work with:

- From Italy, they work in basketball with 6–10 years of experience, coach under-18-year-olds, and also work with professional players.
- From the United Kingdom (England), with 6–10 years of experience, they work in soccer (football) and coach 18–30-year-olds who play for a competitive club or professional team.
- From Saudi Arabia (currently living in the United States), with less than two years of experience, they work in soccer (football) and coach both youth and 25–34-year-olds.
- From the United States, with 2–5 years of experience, they work in baseball and as a strength and conditioning coach, with under-18-year-olds and a few collegiate players.
- From Ireland, with 11–15 years of experience, they work in tennis and coach under-18-year-olds.
- From the United States, with 20+ years of experience, they work in physical therapy with patients primarily between 45 and 54 years old.
- From Ireland, with 2–5 years of experience, they work in tennis and as a physical education teacher, working with under-18-year-olds.

Synonymous with generalizability, or external validity, in quantitative research is transferability, which is about making inferences that extend beyond a particular set of findings (Burke, 2017; Guba & Lincoln, 1994). Moreover, and vital to answering the research question using the listed criteria, the seven

participants were invited with the goal of establishing a technique called "thick description," which shows whether the study findings can be transferred to other settings or groups (Burke, 2017). Achieving a thick description involves the researcher providing enough contextual information and a robust explanation of the assumptions central to the research question (Lincoln & Guba, 1985). The reader then assumes responsibility for transferring the findings to a different context by making a judgment about how sensible the transfer is (Burke, 2017).

Along with the diversity of the semi-structured interview participants as outlined above, the following are additional reasons why only seven were invited to take part: a) the narrow focus of the topic being studied; b) the design of a mixed-methods approach; and c) the quality of the data obtained from the open-ended questions on the survey, which provided saturation (DePaulo, 2000; Guest et al., 2006; Kuzel, 1999; Morse, 2000; Sandelowski, 1995). Lastly, my research interests are grounded in an established theoretical framework, which further substantiates the use of a smaller sample size (Malterud et al., 2016).

3.2. Data Collection Methods

The data were collected through a two-stage approach to investigate the perceived impact on the professional work of sports coaches and practitioners after interacting with and applying ideas from online learning opportunities underpinned by ecological dynamics (aligning with pragmatic interests). A survey was chosen as the first data collection method. Moreover, to maintain reflexivity throughout the entirety of the project, measures were taken to structure the questions in a non-influential way while still providing an opportunity for the participants to share their lived experiences (Smith & Sparkes, 2017; please see Appendix 3.2 for questions). After consulting with the supervisory team and four critical friends (Burke, 2017), the questions were further developed with a specific

focus on learning how the course material may have aided their understanding of ecological dynamics and, more importantly, the extent to which the material equipped them to successfully and confidently apply the ideas and make adjustments in their professional practice—collectively helping to answer the research question in alignment with my pragmatic research paradigm. The four critical friends who were chosen to provide additional feedback about the development of the survey to further assist the supervisors were chosen for the following reasons: a) They have a deep understanding of a mixed-methods approach; b) They have an extensive background in ecological dynamics; c) They are practicing researchers; d) They serve as supervisors to other doctoral students; or e) They are a combination of the above. Moreover, with the assistance of the two groups (i.e., the supervisory team and critical friends), I was able to reduce the risk of possible bias with the way the questions were structured (Driscoll, 2011).

3.2.1. Online Survey

An online survey was chosen as a data collection method for the first stage of my research because it enabled me to collect both quantitative and qualitative data and reach a large number of participants in a limited amount of time from all over the globe (Wright, 2005) who work in different areas of coaching, sports performance, and sports medicine. Furthermore, surveys provide flexibility, which is important for those with busy schedules, and they are also thought to be less intrusive by many, helping to enhance response rates (Evans & Mathur, 2005), therefore allowing more participants to express their thoughts and experiences openly and honestly.

The survey was designed using the Joint Information Systems Committee (JISC) online survey and consisted of 30 questions. Eight of the questions were

demographic questions, and 22 were related to the application of ecological ideas in the participants' professional practice and the impact they perceived. Additionally, the last 22 questions were related to interest in online learning opportunities, interest in contemporary approaches to skill acquisition, and other questions about their experiences interacting with the online learning material. The demographic questions were asked to help me investigate the similarities and differences between individuals when applying the ideas and were relevant for sampling in stage two. Of the 22 questions relating to their interests and experiences, in line with pragmatism and remaining reflexive (through reflection; Dewey, 1933; Mortari, 2015) while writing them, nine were open-ended questions, which provided a platform for detailed expansion. For example, one of the open-ended questions asked was, "How has the Emergence online learning material shaped your practical applications of ideas and reflections on practice?" Even though this type of question could be asked in an interview, when asking questions where the hope is that detailed responses are given, offering participants the opportunity to think about their replies and complete them at their leisure is valuable. The remaining 13 questions on the survey were closed-ended using a 5-point Likert scale response option, which is the most commonly used variation (Bertram, 2007). Moreover, an odd number of possible responses was chosen to provide a neutral option, so participants did not feel forced to choose a positive or negative response (Joshi et al., 2015).

In addition to the closed-ended question, a follow-up probe question was used on four, further peeling back the layers and revealing a great deal of valuable information about the reasoning behind the participants' answers (Smith & Sparkes, 2017). In doing so, I was able to gather more information about their

observations and thoughts after applying ecological ideas within their practice, further assisting me in my investigation.

3.2.2. Online Semi-Structured Interviews

Semi-structured interviews were chosen to accompany the surveys because conversation invited the participants to tell stories, describing their perspectives, insights, feelings, emotions, and behaviors about their experiences applying ecological ideas in their professional practice (Smith & Sparkes, 2017). Importantly, having a conversation allowed participants to clarify, elaborate on, or rephrase a response, further illuminating their knowledge and experience and helping to answer the research question (Fylan, 2005). Lastly, participants can detail their personal accounts during an interview without spending the time to write a lengthy response, aligning with pragmatism by further linking theory and practice.

All semi-structured interviews (n = 7) were conducted and recorded over a video call using Microsoft Teams and lasted between 16 and 50 minutes (mean of 33 minutes). Transcriptions were provided by the Microsoft systems, and time was spent with each one to remove any identifiers and ensure they were correct for the subsequent data analysis. The semi-structured interview questions were written after spending ample time familiarizing myself with the responses the participants offered on the survey (Smith & Sparkes, 2017). Using the responses as a guide, I was able to formulate a set of principal questions, helping to glean even more from their experiences applying the ideas by having them elaborate on their initial comments (Kallio et al., 2016; Ruslin et al., 2022; Whiting, 2008). Ample time was spent reflecting on the structure and tone of the interview questions; through discussion with my supervisors, they were reworded to reduce bias, seeking to ensure they were asked in a non-leading way, and creating space

for the participants to narrate their experiences (Galletta, 2013). Furthermore, the questions were reworded several times to make sure they were open-ended and easy to understand to encourage richer descriptions (Smith & Sparkes, 2017). A pilot interview was conducted to ensure there was a good flow to the conversation, refine the questioning style to reduce bias, and create a platform for interviewee expansion, all of which prepared me as the interviewer to remain open, engaged, and reflexive throughout the discussion (Smith & Sparkes, 2017).

The interview guide was used to ensure there was consistency between participants, with the goal of remaining flexible during the semi-structured interviews (Smith, 2017). Moreover, the questions were asked in a different order depending on how much detail was provided in the opening question, which served as an 'icebreaker' (or warm-up question) to build rapport between the participant and the interviewer and seek to create a comfortable interview atmosphere (Hermanns, 2004). By asking the warm-up question, the participants were able to detail important background information (some of which was removed for privacy reasons), such as where they work and the populations they coach in their professional practice, helping to open lines of inquiry later in the interview to ensure the most could be garnered from their applied experiences. Additionally, being aware of relevant demographics (e.g., the population they work with and their experiences in coaching) helped me ask better questions, stimulate responses about unique situations, and provide valuable information such as the similarities and differences the participants perceived when applying the ideas across different regions of the world where there could be powerful historical and socio-cultural influences (Davids et al., 2008). I believe that this background information was useful in helping to strengthen the findings.

Knowing there might be a situation where they might offer an abbreviated response, sub-questions or probes were prepared, eliciting valuable unstructured responses (McIntosh & Morse, 2015). Moreover, while the same principal questions guided each interview, I remained an “active” listener (i.e., attentive, curious, and responsive; Smith & Sparkes, 2017) throughout the conversation, and follow-up questions (different from the prepared probe questions) often emerged from their responses, further assisting in investigating how each participant applied the ideas in their professional practice. Aligning with the aims of the study and a pragmatic paradigm (Creswell & Creswell, 2022; Morgan, 2007), the follow-up questions were often directed at having the participants discuss the specific application of the ideas in practice (e.g., manipulating task constraints) by using an example or two, which further illustrated their lived experiences, showcasing their understanding, strengths, limitations, and perceived confidence when designing practice activities and interacting with their players or patients. Offering examples helped elucidate any impact they perceived on their coaching abilities, helping to answer the research question (Gibson, 2017; Hesse-Biber, 2010). Enough data were collected using both an online survey, including closed- and open-ended questions, and semi-structured interviews to start analyzing the extent to which the online material may have assisted the participants in understanding ecological dynamics and, more importantly, the impact they perceived after applying key ideas in their professional practice.

3.3. Data Analysis

To analyze the data from the first stage of data collection (i.e., the survey), two methods were used in sequential order. First, to analyze the quantitative data gathered from the closed-ended questions, absolute and relative frequency

percentage values were calculated. The latter enabled me to understand the proportion of observations for each value or class interval of a variable (Turney, 2022). Moreover, descriptive statistics were used as they are considered to be more effective in displaying patterns in data to interested readers due to the ease of summarization and interpretation (Corbett et al., 2019). Therefore, calculating both absolute and relative frequency percentages helped capture the thoughts and experiences of the participants, complementing the qualitative data to gain a more in-depth and contextualized insight into the impact that sports coaches and practitioners perceived after interacting with and applying ecological ideas in their practice.

To analyze the qualitative data—that is, a) the written reply to the probe questions where reasoning was provided for the participants' selected responses to the closed-ended questions, b) the open-ended question responses, and c) the semi-structured interview question responses—a six-phase reflexive thematic analysis (TA) was used (Braun & Clarke, 2012). Reflexive TA was primarily chosen because of its accessibility and flexibility, providing the needed platform for me to immerse myself within the data, remaining open and sensitive, where I was able to familiarize myself with the entire dataset, helping me to develop codes, and eventually generating themes—capturing something important about the data to tell a story and answer my research question (see Appendices 3.3 and 3.4 for initial code and theme development examples; Braun & Clarke, 2012, 2019, 2021).

During the TA, an ‘either-or approach’ was not adopted (i.e., a "top-up" or deductive approach using a preexisting theoretical framework or a "data-driven," "bottom-up," or inductive approach with little pre-determined structure, where the content itself guides the developing analysis; Braun et al., 2017). Alternatively,

as is often the case when using reflexive TA, both inductive and deductive approaches were included throughout (Braun et al., 2017). For example, when analyzing the data, an ecological dynamics framework, which this study is based on, guided my interactions with the data (deductive approach). Furthermore, I remained reflexive, letting the data itself (inductive) and the thoughts and experiences shared by coaches and practitioners guide code and theme development, further understanding the theory-practice link.

The survey data were analyzed to the point just before phase five, which includes defining and naming themes. After developing provisional or candidate themes for the survey data, analysis was put on hold until the completion of the second stage of research—semi-structured interviews. Progressing this far in my analysis was informative for learning about the participants' experiences and the impact they perceived from the online learning material, which better prepared me to develop quality semi-structured interview questions and then engage with them in conversation, helping to reveal an indispensable source of rich knowledge (Smith & Sparkes, 2017). The semi-structured interview data analysis and amalgamation between the two data sets that followed will be addressed later in this chapter.

3.3.1. Analyzing the Survey Using Reflexive Thematic Analysis

The first phase involved *familiarization* with the data set, where I immersed myself in the data to become one with the messages the participants shared in response to the open-ended survey questions or the probe questions, which asked them to provide reasoning for the selected response to the closed-ended questions. The entire data set was read twice in a different order, unburdened by tasks such as note-taking, which was important to get a feel for the thoughts being shared in response to the open-ended questions before any coding began

(Byrne, 2021). Even though codes were not being developed during this phase, it was still an "active process," as was the entire analysis (Braun et al., 2017). During this phase, getting to "know" the data and better understanding how the ideas shared addressed my research question was critical. Conversely, while getting to know the data was important, engaging with the data as information (i.e., inductively or data-driven) was also prioritized (Braun & Clarke, 2012). Following suggestions from Braun et al. (2017), questions such as "Why might the participants be making sense of things in this way (and not that way)?, were continually circulating as I read the responses. Even though notes were not taken while reading and highlighting, after familiarity with the data following two full reads, a few thoughts (primarily shorthand and just a few words) were written down to guide the code generation, some of which informed the final thematic framework.

The next phase—*coding*—was a very detailed process yet highly valuable to the subsequent candidate theme development (Braun et al., 2017). This process involved reading back through the entire data set, where “codes” or labels that captured something relevant in the data in relation to the research question were identified. Nine open-ended and four probe questions were coded—this was done holistically and not as individual questions. As mentioned earlier, 47 participants completed the survey with rather detailed responses, which offered me a glimpse into their applied experiences to learn more about the impact they perceived in their professional practice. In line with the pragmatic research paradigm, coding was done at the semantic (i.e., the obvious meanings expressed staying very close to the content of the data) and latent levels of meaning—meanings beneath the semantic surface of the data (Braun et al., 2017)—to glean the most from their experiences.

Upon completion of the first iteration of the coding, which yielded 67 codes, consultation was pursued with a supervisor to offer support and guidance in the coding process. After discussion, the entire data set was meticulously reread with a reflexive mindset to ensure the codes were appropriate. During this process, numerous codes were consolidated where there was superfluous coding (a code was created later in the process that had a similar meaning as one previously developed, i.e., it was redundant) while remaining open and inclusive, keeping in mind that themes had yet to be created (Braun et al., 2017). As the coding continued, I felt that enough was generated that captured both diversity and the emerging patterns observed within the data (yielding 45) (Braun & Clarke, 2012), leading to the progression to the third phase—*searching for and generating candidate themes* (see Appendix 3.5 for evolving survey data analysis: theme development examples).

This phase was an active process where the goal was to construct candidate themes that helped create a plausible narrative about the data and capture rich diversity rather than a single idea, collectively helping to answer my research question. To do this, I reviewed all of the codes and clustered them based on areas of similarity and overlap (Braun et al., 2017). For example, the codes "By understanding more about the performer-environment relationship and constraints that shape behavior, my session design (and constraint manipulation) has improved to meet individual learner needs" and "Finding a functional fit in representative environments is more important than isolated technique drills" share some similarities. Both have several unifying features (e.g., the importance of individuality and authenticity, problem-solution dynamics, and the power of the performer-environment relationship), describing a coherent and meaningful pattern in the data (Byrne, 2021). During this phase, the main goal was to ensure

that the candidate themes had sufficient depth and detail to convey a meaningful story about the dataset (Braun & Clarke, 2012). Additionally, while some of the themes had more individuality to them, this phase was focused on searching for the relationship between the candidate themes. For example, "Coaching Changes (Harnessing the Performer-Environment Relationship)" and "Ability (Confidence Supports Application)" both convey the ideas of learning, purposeful coaching, confidence, and development and collectively captured 16 codes, offering helpful insight about the data in relation to the research question. At this point, both were kept as potential stand-alone themes.

To begin the fourth phase—*reviewing potential themes*—time was spent comparing each theme (seven were created at this point) to the collated extracts that were checked against the themes to see if they worked (Braun & Clarke, 2012). During the process of reviewing the entire dataset and the collated extracts of data, it became clear that five themes were more closely related than the other two. This was because there were several questions centered around the interests and recommendations of the participants (e.g., "What interests you in learning more about a contemporary approach to skill acquisition?" and "Do you have any suggestions for improvements, refinements, or modifications to the Emergence online learning material?"). These questions generated entirely different responses, which led to codes and potential themes that differed from the responses to questions directed at the impact perceived from the course material after applying the ideas in their professional practice. While the information is valuable, the decision was made to include the information in the results and discussion chapters and not include the two potential themes that were created. This was done primarily because the data, codes, and potential themes were not directly related to answering the research question. So, while

important for learning about trending interests and future content development, they were not included as the reflexive TA continued. After concluding the fourth phase of reflexive TA of the survey data, which yielded 28 codes and five themes, data analysis of the semi-structured interviews began. The final two phases occurred during the amalgamation of the two datasets.

3.3.2. Analyzing the Semi-Structured Interviews Using Reflexive Thematic Analysis

Similar to the survey data analysis, the first phase of analyzing the semi-structured interviews involved familiarization, where I listened to the interview recordings and read the transcriptions, immersing myself in the indispensable information about the participants' rich and in-depth experiences applying ecological ideas in their professional practice (Braun et al., 2017; Smith & Sparkes, 2017). The first time I engaged with each interview, I started at the beginning and the second time in the middle, before revisiting the first half to see if I could pick up anything that I may have missed when first listening. No notes were taken during the first two listening sessions, so I could fully engage with their responses, actively listening (Smith & Sparkes, 2017) like I did while conducting the interviews, so I could detect more from their body language and the tone of their voice, helping to glean more from them to answer the research question. After listening to the semi-structured interviews twice, starting at different places each time, I read the transcripts from start to finish during my third engagement with the interviews, highlighting important responses that captured their experiences to assist in the next phase of data analysis.

Coding followed the familiarization phase, which was an integral part of the process, where the transcriptions were scrupulously read, this time developing codes (i.e., labels) that captured something relevant in the data in

relation to the research question (Braun et al., 2017). In line with the pragmatic research paradigm, coding was done at the semantic and latent levels of meaning to extract the most from their experiences, and the first iteration yielded 22 codes. During the second iteration, the interview transcriptions were intently reread with a reflexive mindset to ensure the codes were open and inclusive (Mortari, 2015; Braun et al., 2017) and appropriately captured the thoughts and experiences of the participants. Numerous lines of data were relocated under codes that were more conducive to interpreting themes, and the coding phase concluded (yielding 20) after patterns within the data were identified while capturing the diversity of the positions held by participants (Byrne, 2021).

The third phase consisted of searching for themes, or more appropriately, generating candidate themes, starting with a shift from interpreting individual data items within the dataset to the interpretation of aggregated meaning and meaningfulness across the dataset (Braun et al., 2017). During the first iteration of generating candidate themes, codes were clustered based on areas of similarity and overlap (Braun et al., 2017), capturing in-depth diversity rather than a single idea to help tell a story about the data, collectively helping to answer my research question (Braun & Clarke, 2012, 2019, 2021). During this phase, which consisted of two iterations, multiple codes were collapsed into one unifying code because they shared similar concepts (Byrne, 2021), revealing patterns leading to the development of four candidate themes.

During the fourth phase—reviewing potential themes—the data items were revisited, leading to several being relocated because of a better relationship with different codes. Next, the codes were reviewed that informed each theme, and a series of questions were answered to better understand the intricacies of each theme, including their boundaries (what they include and exclude), whether

the candidate themes were "thin or thick," and their usefulness in telling a story about participants' experiences to answer my research question (Byrne, 2021). In doing so, two themes seemed to highlight an important aspect of one central theme, so they were changed to sub-themes (Braun et al., 2017). While remaining reflexive in my analysis, each code was again reviewed to confirm whether it appropriately informed each theme or sub-theme. A few codes were restructured, and others were removed (ending the phase with six) to facilitate the most meaningful interpretation of the data. This phase concluded with a thematic map capturing the most important elements of the data relating to the research question (Byrne, 2021). As with the analysis of the survey data, the analysis of the semi-structured interviews stopped after the fourth of six phases in preparation for amalgamating the data between the two stages of research to complete the final two phases of reflexive TA to produce the final report.

3.3.3. Amalgamating the Survey and Semi-Structured Interview Data to Complete the Reflexive Thematic Analysis

To complete the final two phases of the reflexive TA, the data gathered during the survey (first stage) and semi-structured interviews (second stage) needed to be amalgamated, assisting me in telling a comprehensive story about the data to answer my research question (Braun et al., 2017). To begin the amalgamation of the different data sets, I meticulously reread the data, the first time without taking any notes and the second taking detailed notes about similarities between survey responses and the semi-structured interviews. Throughout the process, numerous lines of data were moved to different codes (some new and some reworded) that more appropriately captured the essence of the participant responses. Moreover, actively searching for and discovering common themes expressed by participants after applying the ideas in their

professional practice was critical to relocating codes under more appropriate themes, and the deep analysis also assisted in the rewording of codes and the consolidation of others. A pragmatic paradigm guided the amalgamation process (yielding 15 codes), and a lucid narrative began to emerge, helping to begin creating themes with the goal of advancing the understanding of applied practice in sports (Morgan, 2007).

After the amalgamation of the data sets, I began the fifth phase of analysis—defining and naming themes. After a deep investigation of the data, two themes and two sub-themes were generated that subtly changed from the potential themes from earlier analysis, collectively telling a compelling story and capturing the vivid experiences shared by the participants. Additionally, throughout the analysis, multiple data items were selected to be used as extracts in the results chapters (i.e., chapters 4-6) to inform each theme and sub-theme and demonstrate cohesion while expressing diversity among the constituent data items (Byrne, 2021). The final phase of the reflexive TA consisted of producing the report, or the 'write-up', which is very much interwoven into the entire analysis process since notes were continuously taken from start to finish (Braun & Clarke, 2012). The final ‘write-up’ can be found in the results chapters below.

3.4. Research Quality and Rigor

Reflexivity is regarded as a crucial component of research practice, particularly in qualitative research (Watt, 2007). Reflexivity is important to ensure the credibility of results by reducing the chances of the researcher's bias throughout the study. Steps were taken during both stages of the research project to ensure methodological rigor. First, in an effort to limit any bias, early in the survey analysis process, in my reflective journal, I wrote, “Make sure to interact with the data with an empty cup,” so I was reminded to investigate what was

actually written and the underlying meaning in the participant responses. I revisited the statement any time I interacted with the data, as it was a helpful reminder. Furthermore, to support my supervisors and the numerous conversations we had, three of the four critical friends (as elaborated on above; see section 3.2.) assisted in reviewing the questions being asked on the survey to ensure bias was eliminated and that they were worded to elicit in-depth personal accounts of the participants' experiences, helping to answer the research question (Brewer & Sparkes, 2011; Burke, 2017). As a result, numerous questions were reworded, improving the quality of the survey. For example, a middle response was added on a few questions (i.e., "no change"), per suggestion by a supervisor, increasing the research quality and rigor before the surveys were delivered (Barusch et al., 2011). As elaborated on above (see section 3.1.1.), participant sampling was carefully conducted for the survey using a) the types of courses they had engaged in and b) relevant demographic considerations. This was done to ensure consistency between experiences and to capture diversity, creating depth across experiences.

When participant sampling was done for the semi-structured interviews, the following inclusion criteria were considered to ensure a diverse and robust participant group was selected, capturing a range of experiences when ecological ideas were applied in practice: a) location of employment; b) occupation; c) length of time practicing; d) population coached; and d) the quality of the survey responses (McHugh, 2017). After spending substantial time analyzing the survey data (i.e., reading and reviewing to develop codes and themes) of the selected participants, several fixed questions were written and then reviewed by a member of the supervisory team who has an extensive background in qualitative research methods, helping shape the fixed questions and assisting with probe question

considerations. The pilot interview conducted before the first semi-structured interview was integral to further sharpening the delivery of the interview questions to help answer the research question (Majid et al., 2017). Throughout the interview, I remained attentive to the direction of the conversation and used words like "sure" or "I see" and other short phrases to let the participants know I was following, without using phrases such as "I agree" or “I’m not sure about that," which would show bias. Follow-up questions such as "Can you tell me more about that?" or "Do you mind offering an example from your practice highlighting your experience applying the ideas?" and "What was it like being there?" were used instead to help me learn more about their lived experiences while remaining unbiased in my responses (Smith & Sparkes, 2017).

In line with a pragmatic research paradigm, it is critical to acknowledge my personal biography, given that my previous experiences were a motivation for undertaking the current study. At the time of this writing, I have co-authored four peer-reviewed scientific journal articles and one book section underpinned by the ecological dynamics approach to skill acquisition, and I am currently working on two other publications. An important point to emphasize is that a major goal of my research is to help coaches and practitioners understand and subsequently *use* contemporary frameworks, like ecological dynamics, to improve learners' experiences in sports.

Moreover, I have been working in the field of sport and exercise as a coach and educator for nearly 20 years. Rather than considering such influences as a potential pollutant, prospective (concerning the effect of the whole-person researcher on the research) and retrospective (concerning the effect of the research on the researcher) reflexivity were engaged to confirm the significance of the knowledge, feelings, and values that were brought to the conceptualization

of the research questions and the analytical lens applied to the findings (Attia & Edge, 2017; Braun & Clarke, 2019).

Following recommendations from Smith and McGannon (2018), an independent critical friend was used during the data analysis process over alternatives such as inter-rater reliability conversations (Campbell et al., 2013). Of my four critical friends, the one selected works as an independent researcher and skill acquisition specialist and has worked in the industry for over 20 years. Throughout the analysis process, the role of the critical friend was "not to 'agree' or achieve consensus but rather to encourage reflexivity by challenging the construction of knowledge" (Cowan & Taylor, 2016, p. 508). In addition to using a critical friend, the data collected during the survey and semi-structured interviews were often discussed with the lead supervisor, who served as a sounding board, offering advice that helped me adopt a self-critical attitude and reminded me to ruminate about how preconceptions could affect the analysis. In doing so, I was encouraged to reflect upon and further explore the data, which helped me remain reflexive throughout the data analysis process (Brewer & Sparkes, 2011). Early in the coding process, the analysis was too superficial; after discussions with my lead supervisor, I searched for patterns in the data and was able to eliminate superfluous codes and discover underlying messages beneath the surface of the explicit responses.

In conclusion, it should again be acknowledged that I am the co-founder and co-director of education at Emergence, which is the education company where the participants have engaged in online learning. That said, numerous measures were taken (as outlined above) to remain unbiased and reflexive throughout the research study to ensure credibility (i.e., trust and accuracy; Pitney, 2004), so the findings further the research community's understanding

and help impact practice (Burke, 2017). When this research project began, Emergence was the only online company offering education entirely underpinned by ecological dynamics, which is why they were selected. Additionally, Emergence provided no financial support for this research project. By investigating the perceived impact on the professional work of sports coaches and practitioners after engaging with Emergence online education, other coach education companies, national governing bodies, and universities (especially those with online platforms) stand to gain invaluable information about the impact perceived by sports practitioners, which can serve as a guide to refine learning opportunities, thus influencing the development of sports players worldwide.

3.4.1. Additional Ethical Considerations

After ethics approval was given by the University of Gloucestershire School of Sport and Exercise (now called the School of Education and Science) Research Ethics Panel (SSE-REP) on September 27, 2022, numerous steps were taken throughout the research study to ensure the highest ethical standards were followed, specifically in obtaining informed consent and handling sensitive information (Palmer, 2017). All of the participants were over 18 years old, and all communication with the participants occurred through my university email address. The information obtained from the participants was kept in password-protected email files 'in the cloud' or on the JISC software where the survey was developed. Other than myself, the only other individuals with access to any information obtained from the participants were my two supervisors. After being selected for the first stage of the research study (i.e., the survey), participants received an invitation email that described the project and why they were being asked to participate. Additionally, they were informed about their rights (including the right to withdraw at any time, without consequence) and that all the data

disclosed was kept private and confidential, password-protected, and only accessible to the research team (Palmer, 2017). They were also informed that any raw, non-anonymized data would be deleted as soon as the project ended and that anonymized data might be retained for future research purposes.

In the invitation email, participants were directed to the online survey, where they were required to answer several questions and give informed consent to begin the survey (please see Appendix 3.6 to read the informed consent form). After being selected for the semi-structured interview based on the need for demographic diversity in the sample, participants were once again emailed, inviting them to participate in the second stage of research. New informed consent forms were signed, which included details about their rights as participants (e.g., the ability for them to refuse participation or withdraw from the study up to one month after they completed the interview without consequence). Before asking for their permission to record the interview, participants were once again reminded about the purpose of the interview, the format, the terms of confidentiality, and how they could contact the research team if needed (Smith & Sparkes, 2017). The interviews were conducted on Microsoft Teams, and the recordings were stored on OneDrive. Following the interviews, the transcripts were reviewed, and all identifying information was removed, further protecting the participants (Stiles & Petrila, 2011). Finally, additional pertinent information can be found in the appendices (e.g., University of Gloucestershire ethics approval, semi-structured interview purpose, and schedule).

3.5. Conclusion

In this chapter, the research paradigm and methods used to answer the research question have been discussed. The first stage of the data collection included an online survey, allowing me to collect both quantitative and qualitative

data and reach a large number of participants in a limited amount of time from all over the world (Wright, 2005) who work in coaching, sports performance, and sports medicine. The second stage included semi-structured interviews and was chosen to accompany the surveys because conversation invited the participants to tell stories, describing their perspectives, insights, feelings, emotions, and behaviors about their experiences applying ecological ideas in their professional practice (Smith & Sparkes, 2017). A mixed-methods approach was chosen for this study to capture a panoramic view of the participants' perceptions (Creswell, 1999; Gibson, 2017) and better understand the impact that the sports coaches and practitioners perceived after applying the ideas they interacted with in the online courses. The next chapter begins the results and discussion, delineating the impact perceived by sports coaches and practitioners after interacting with and applying the online material underpinned by ecological dynamics.

Chapter 4: Coaching Changes (Harnessing the Performer-Environment Relationship)

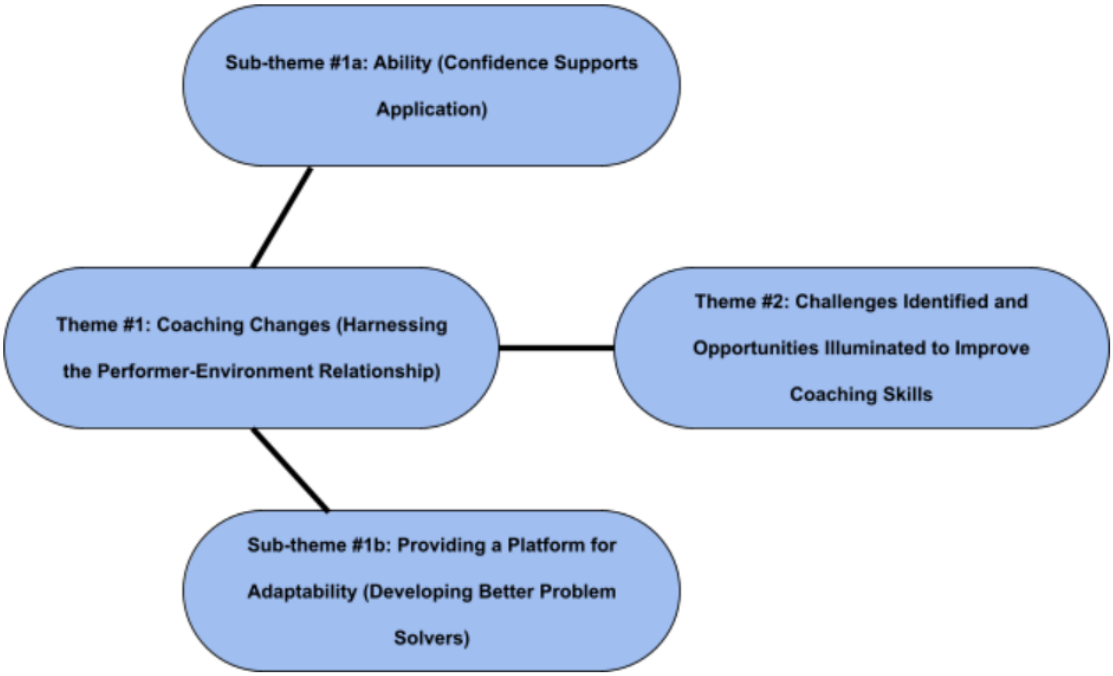
4. Introduction

The following three chapters present and discuss the findings (i.e., the amalgamated data from the survey and semi-structured interviews), which tell a rich narrative, answering the research question. The current chapter (i.e., Chapter 4) starts by introducing the quantitative data before discussing the principal theme developed during the reflexive thematic analysis (TA), titled "Coaching Changes (Harnessing the Performer-Environment Relationship)," and the qualitative data that supports its development (see Figure 4.1 for the thematic map). Chapter 5 unpacks the two sub-themes titled “Ability (Confidence Supports Application)” and “Providing a Platform for Adaptability (Developing Better Problem Solvers).” The two sub-themes support the principal theme (i.e., “Coaching Changes”), highlighting the confidence coaches and practitioners perceived, which assisted them in making changes in their coaching. Chapter 6 discusses the second of two main themes titled “Challenges Identified and Opportunities Illuminated to Improve Coaching Skills,” which describes areas that coaches found difficult when seeking to utilize ecological ideas in their professional setting.

Moving into the findings, it is important to review the objective of my research, which was to investigate the impact the participants (primarily referred to as coaches and practitioners moving forward) perceived after interacting with "ecological ideas" online (i.e., through pre-recorded courses and live interactions) and their subsequent application in their professional practice. My specific focus was on understanding the strengths and limitations (weaknesses) they experienced and the extent to which confidence may have impacted their application.

Figure 4.1.

Thematic map developed during the reflexive thematic analysis of the data.



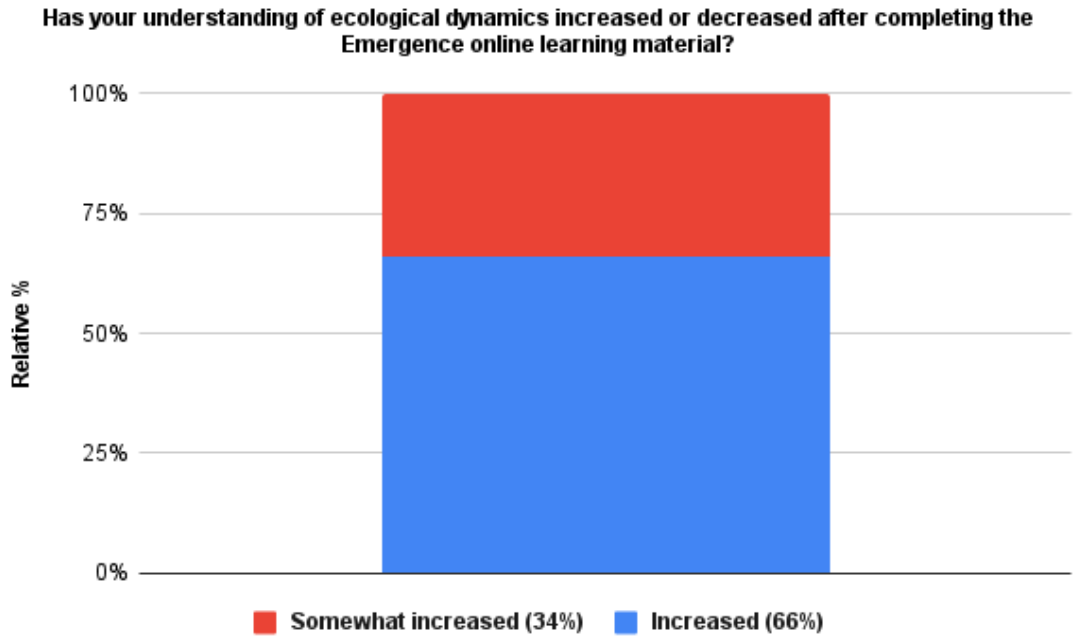
The principal changes the coaches and practitioners made were designing learning environments more representative of the sport and purposefully manipulating constraints to provide a platform for skill development. In addition, changes to communication strategies were also noted, transitioning from instructing athletes and patients about how to perform specific techniques followed by copious feedback after the execution to guiding them by asking questions and making brief statements to educate their search. This change was made to help encourage exploratory behavior or to guide their perceptual pick-up of information, where they could organize individual-specific movement solutions to solve emerging movement problems (Chow et al., 2022). As a result of the changes, a key finding observed by coaches was a noticeable improvement in skill levels as a result of practice.

4.1. Quantitative Survey Data

Several column charts are displayed below to contextualize the qualitative data presented in the following sections (Creswell & Creswell, 2017). The findings help complement the qualitative data, offering more depth to understand the experiences of sports coaches and practitioners after interacting with and applying ecological ideas in their practice. Looking at Figures 4.2 and 4.3 together tells an in-depth story. As shown in Figure 4.2, 100% responded that their understanding of ecological dynamics increased (66%, 31 of 47 participants) or somewhat increased (34%, 16 of 47 participants) after completing the online material.

Figure 4.2.

The degree to which the participants' level of understanding of ecological dynamics changed after completing the Emergence online learning material.

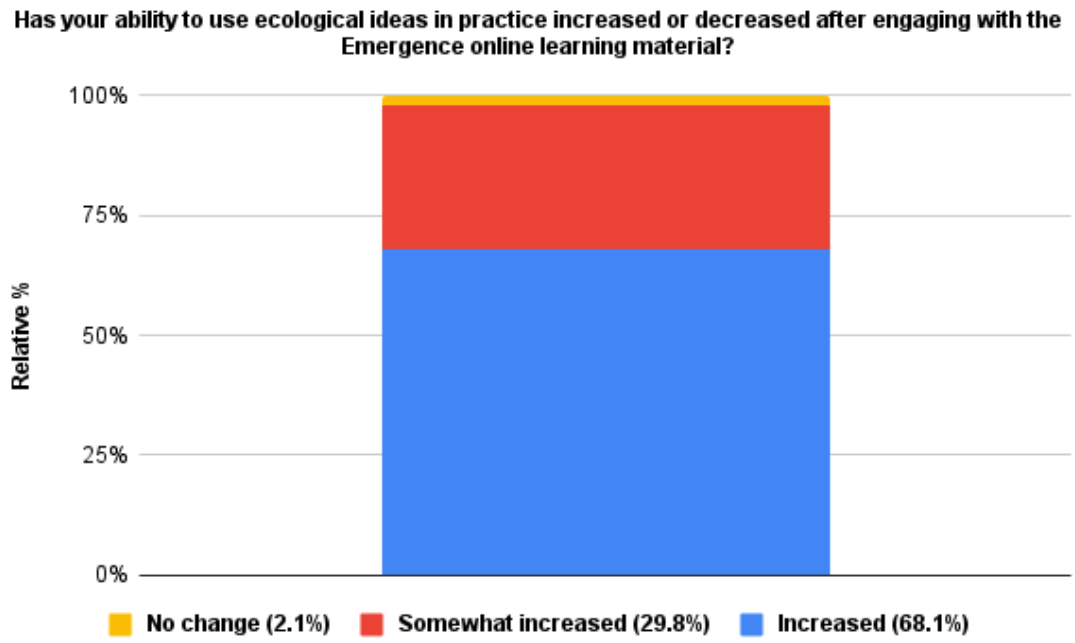


More importantly, Figure 4.3 shows that 97.9% reported that their ability to use the ideas in practice increased (68.1%, 32 of 47 participants) or somewhat increased (29.8%, 14 of 47 participants), which tells a convincing narrative.

Several coaches and practitioners stated they came in with a basic understanding of ecological dynamics but were interested in gaining a deeper understanding, while others claimed the ideas were relatively new to them. As reflected by the numerous comments in the following sections, the online educational material provided more clarity or offered a foundation to begin applying the ideas in practice, with 37 of the 47 participants who filled out the survey making explicit statements. Collectively, the comments describe the value they received after engaging with the material (e.g., see section 5.1.1).

Figure 4.3.

The degree to which the participants' ability to use ecological ideas in practice changed after engaging with the Emergence online learning material.

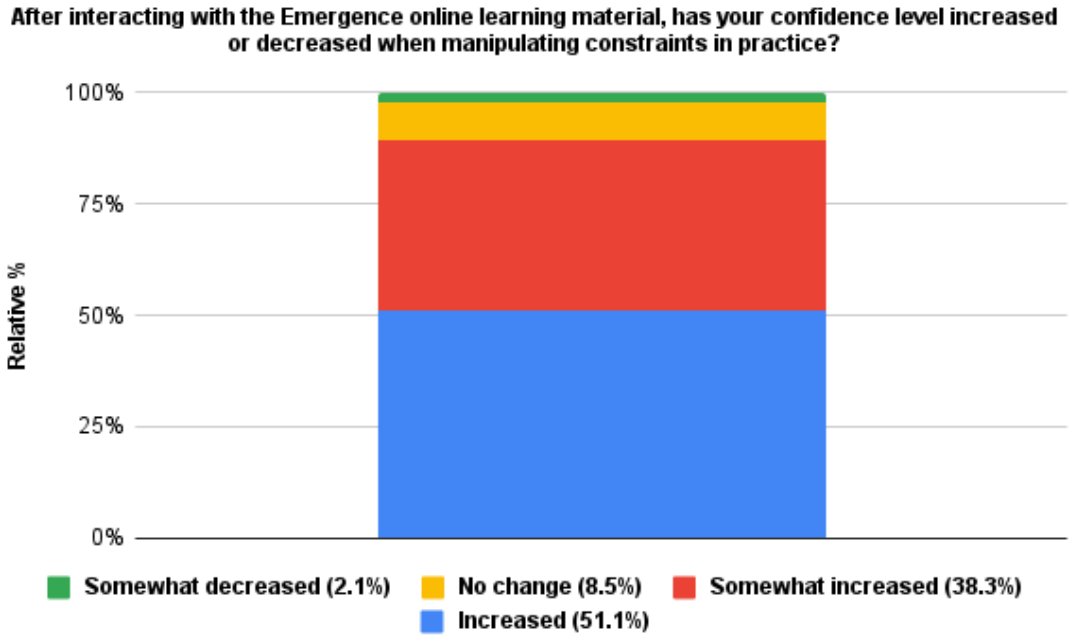


Two key ideas central to ecological dynamics and nonlinear pedagogy (NLP) are constraint manipulation and representative learning design (RLD). Figure 4.4 shows that 89.4% commented that their confidence when manipulating constraints in practice increased (51.1%, 24 of 47 participants) or somewhat

increased (38.3%, 18 of 47 participants), which is critical to appropriately challenging athletes so their skills adapt and develop.

Figure 4.4.

The degree to which the participants' confidence level increased or decreased when manipulating constraints in practice after interacting with the Emergence online learning material.

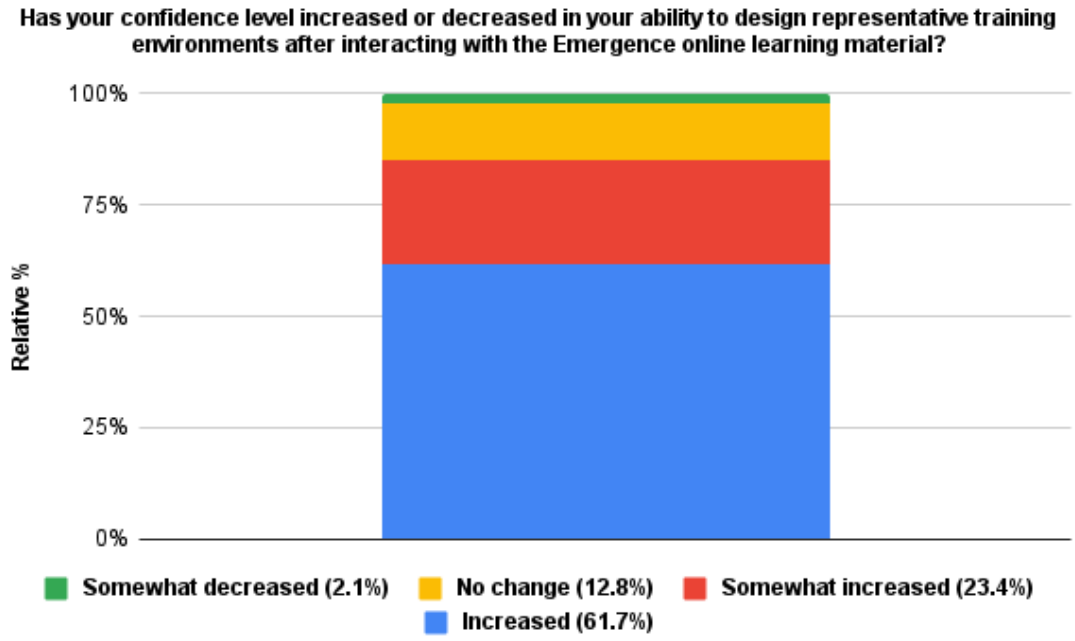


Moreover, 85.1% reported that their confidence increased (61.7%, 29 of 47 participants) or somewhat increased (23.4%, 11 of 47 participants) in their *ability* to design representative learning environments after interacting with the online material, as shown in Figure 4.5. In sections 4.2.2 and 4.2.3, coaches from multiple countries, all with varied backgrounds and experience, describe the changes they made to their professional practice related to RLD and constraint manipulation, which suggests the impact the material had on their craft. Interestingly, both figures show a 2.1% decrease in confidence. These findings are not overly surprising given that the coaches and practitioners may have been interacting with courses where they were presented with a contemporary

approach to skill acquisition for the first time, which may go against some of the beliefs they previously had, possibly leading to confusion. Future courses could offer additional examples across more sports to introduce coaches to how ecological ideas are applied in practice. Doing so could increase confidence by specifically addressing the sport within which they work.

Figure 4.5.

The degree to which the participants' confidence level increased or decreased in their ability to design representative training environments after interacting with the Emergence online learning material.

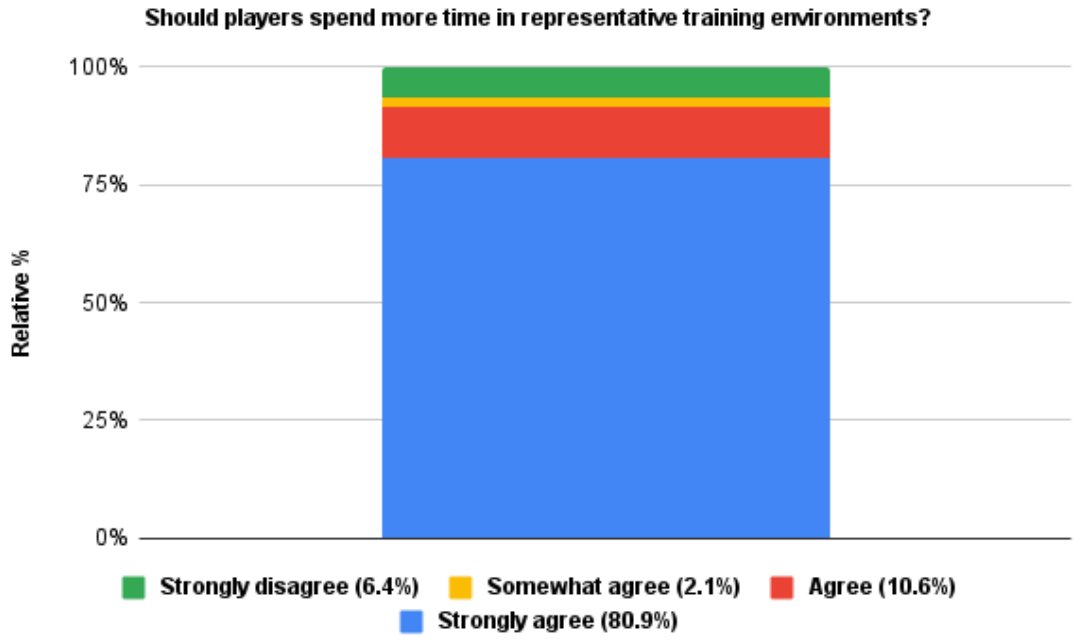


Adding to the increased confidence in applying the ideas in practice, 91.5% of coaches (e.g., see Figure 4.6) strongly agreed (80.9%, 38 of 47 participants) or agreed (10.6%, 5 of 47 participants) that performers should spend more time in representative training environments. It may seem intuitively obvious to embed players in learning environments that look and feel like their sport. However, practices across many sports, from mixed martial arts (MMA) to basketball, are still ridden with the rehearsal of techniques or patterns in

unopposed situations, which is not conducive to a contemporary approach to skill acquisition (Yearby et al., 2024). Diego makes this observation, as seen in Section 4.2.2. The overwhelming belief that learners should be embedded in representative training environments or ‘slices’ of the sport more often (Yearby et al., 2022) is a testament to the impact perceived from the online learning material.

Figure 4.6.

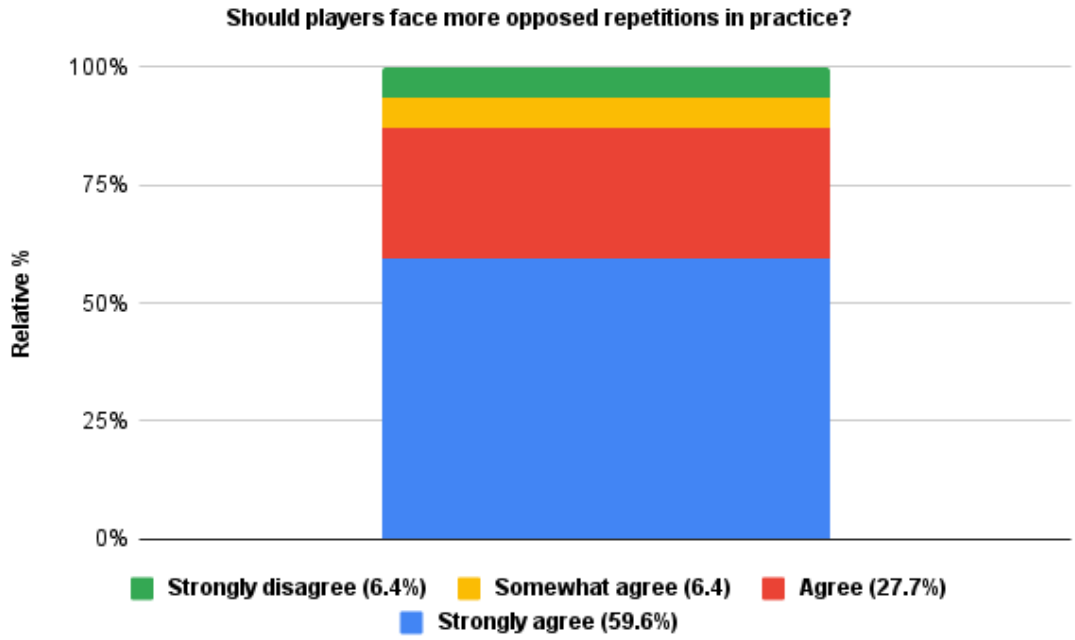
The degree to which the participants’ agreed or disagreed that players (or athletes) should spend more time in representative training environments after interacting with the Emergence online learning material.



Moreover, Figure 4.7 shows that 59.6% of coaches (28 of 47 participants) strongly agreed, 27.7% (13 of 47 participants) agreed, and 6.4% (3 of 47 participants) somewhat agreed that athletes should face more opposed repetitions in practice, which indicates that they are proponents of representative training environments for skill development.

Figure 4.7.

The degree to which the participants' agreed or disagreed that players (or athletes) should face more opposed repetitions in practice after interacting with the Emergence online learning material.



Another idea at the center of ecological dynamics is the individual (or athlete)-environment relationship, where players own their decision-making since affordances are described as individual and frame-dependent (Davids et al., 2008). Figure 4.8 illustrates the value coaches place on prioritizing exploratory behavior and movement problem-solving in practice. Moreover, the impact they perceived from the online learning material and the changes they made to their guidance and feedback strategies to assist athletes in searching for individually relevant movement solutions are addressed in Section 4.2.6. The 89.1% of coaches and practitioners (e.g., see Figure 4.8) who responded that athletes should 'own' their decision-making rather than being told to behave following the coach's way of being and doing is a staggering percentage since it conflicts with traditional approaches to skill acquisition. To design learning environments that

are ‘alive’ and representative and that challenge individual skill development, coaches should be capable of analyzing movement in context.

Figure 4.8.

The degree to which the participants’ agreed or disagreed that players (or athletes) should own their decision-making during practice based on their action capabilities after interacting with the Emergence online learning material.

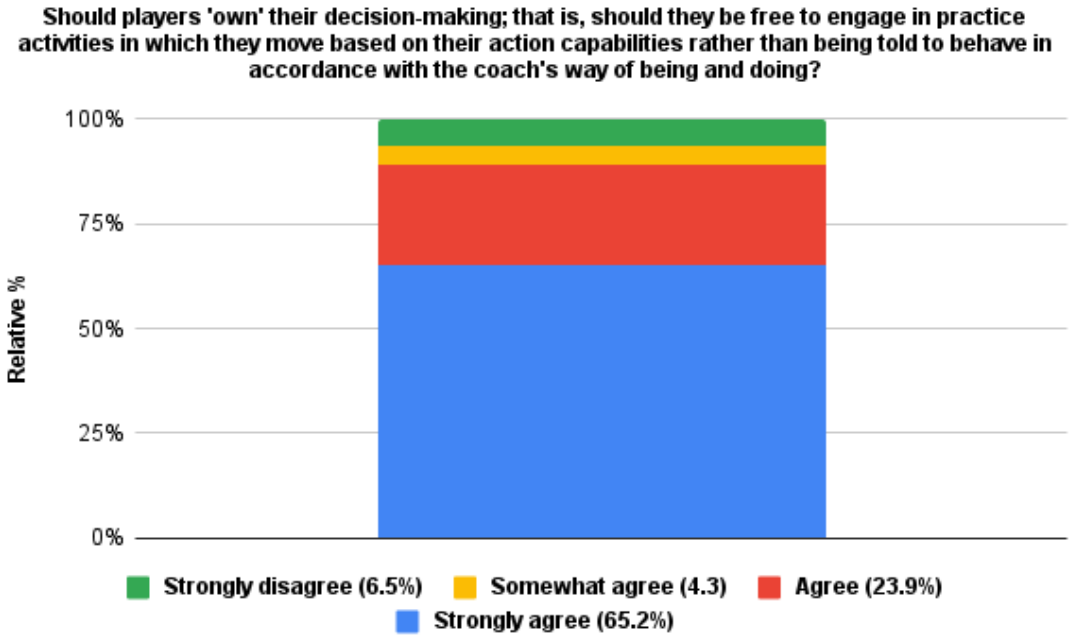
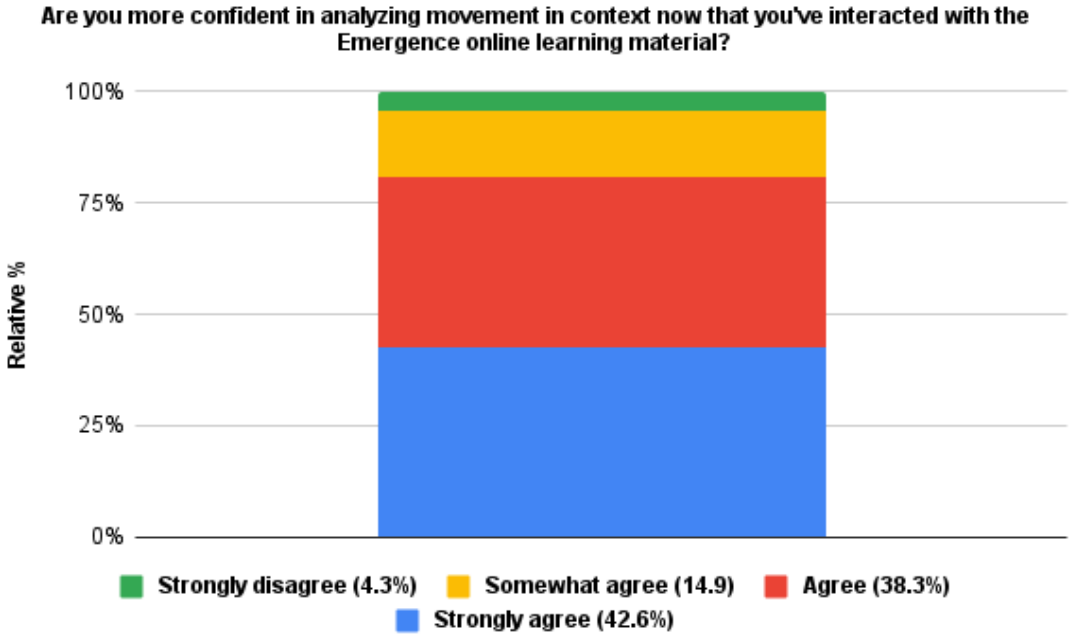


Figure 4.9 shows that 42.6% of coaches strongly agreed (20 of 47 participants), 38.3% agreed (18 of 47 participants), and 14.9% somewhat agreed (7 of 47 participants) that they are more confident analyzing movement in context after interacting with the Emergence online learning material. This is a promising finding, which suggests that coaches found the material valuable, enhancing their coaching abilities. Next, the qualitative findings are discussed to complement the quantitative data, collectively answering my research question.

Figure 4.9.

The degree to which the participants' agreed or disagreed that their confidence level improved when analyzing movement in context after interacting with the Emergence online learning material.



4.2. Theme #1: Coaching Changes (Harnessing the Performer-Environment Relationship)

The first of the two main themes generated during the reflexive TA of the data and the one that supports the two sub-themes is titled *Coaching Changes (Harnessing the Performer-Environment Relationship)*. This principal theme was generated for two main reasons: there were numerous changes made to the coaches' and practitioners' pedagogy, and the changes originated from a better understanding of the importance of the performer-environment relationship. A definition of the sub-theme is presented below, followed by findings that support its development.

Coaching Changes (Harnessing the Performer-Environment Relationship)

After interacting with the online learning material underpinned by a contemporary approach to skill acquisition—an ecological dynamics framework—many coaches and practitioners made numerous changes to their professional practice. Most notably, there is a newfound appreciation of the performer-environment relationship where movement problem-solving is embraced. With a deeper understanding of the emerging problems athletes face through contextual movement analysis, more relevant practice activities can be designed that are 'alive' and representative of their sport. For most, communication (e.g., instruction and feedback) is now directed at guiding an athlete's search rather than demanding particular actions or telling them what not to do. Coaching is now viewed as a co-adaptive relationship with an appreciation for representative co-design, where their rich experiences help guide activity design. Moreover, priority has been placed on ownership and exploration during training, which has given rise to more engaged athletes and more enjoyable sessions.

4.2.1. Coaching Changes and the Impact of Using Nonlinear Pedagogical Principles in Practice

As mentioned, one of the specific focuses of this study was investigating any strengths that the coaches and practitioners perceived in their professional practice after interacting with and applying ecological ideas delivered online. An important reminder when considering the transferability of the findings (Burke, 2017) is that the coaches and practitioners span 11 countries, all have varied qualifications and experience, and occupy different professions (e.g., basketball coaches to physical therapists). Below, seven comments are highlighted to set

the stage for other notable strengths and positive changes perceived in their practice.

Arthur summarized, "I feel like I have developed coaching superpowers: I listen more intently, I am more adaptable, and I can respond effectively." Similarly, Liam stated, "Well, I think, for me like being totally honest, it's actually been; it has kind of been game-changing." Oliver, working in football (soccer), adds:

> If I compare myself to the point in time when I started the Emergence courses, I can see a night-and-day difference in my skill sets and knowledge as a coach. I feel I possess more 'strings to my bow' in my coaching tools—pre-session, during the session design process, during the session, and in post-session analysis.

As mentioned, these game-changing observations extend beyond sports coaching, as Peter, who is a physical therapist, added, "For me, applying the ideas that I learned through Emergence, [um], really it, it completely changed the way that I practice and how I look at things… It's also completely changed the way that I prescribe exercises. I am much more willing to deviate out of the normal. I am much more willing to really be creative with, with exercises based on what the person's needs are." Anton had related experiences after engaging with the online material, saying, "It has changed almost everything. Transfer from practise to the game is totally on a different level." For Giovanni, who works in basketball as a head coach, the material completely reshaped his view; he expressed:

> It really helped me connect the dots and understand how you can use an ecological approach to integrate every part of an organization, and I would say that where I'm at now is kind of seeing the game through a highly integrated organizational approach where you use [ecological] dynamics as a framework to tie the front office to coaching, to athletic performance analytics, to scouting—everything. And I'd say that that kind of start, that whole journey of where I am now, I'd say it actually really [did] begin by looking at those courses because I realized it wasn't just in my field and coaching; I realized it went far deeper than that.

Jeff, who works in baseball, had similar experiences, emphasizing:

> This has changed my perspective on coaching tremendously. I now zoom out and look at all the factors to see what is influencing a movement. Then that helps me guide the athlete to come up with their own solution vs. me providing the solution for the athlete and enabling their ability to problem solve.

Taken together, these statements convey a meaningful message about the perceived value of their experiences learning about and applying ecological ideas and suggest a changed perspective, which has a direct impact on the practices they design and the interactions they have. That said, when a coach decides to change their approach, it can be helpful to have principles to guide the process (Wood et al., 2022; Lascu et al., in press).

As discussed earlier (see section *2.2.5.),* NLP consists of five key principles, placing athlete-environment interactions at the center of practice task design. In doing so, functional relationships between performers and performance contexts are promoted (Button et al., 2020; Renshaw et al., 2019; Myszka et al., 2023a; Yearby et al., 2024). Many of the strengths perceived by coaches after interacting with the online education aligned with the key principles of NLP (e.g., the helpfulness of shifting practices to become more representative of the sport, so key informational variables can be perceived by players). In the following sections, each principle is explored with relevance to sports coaches' and practitioners' experiences applying them in their professional setting, along with notable reflections that highlight the impact they perceived in doing so.

4.2.2. Applying Representative Learning Design

Ecological dynamics, which embraces the notion of RLD, rejects the historically held preference for organism-centered explanations of performance (O'Sullivan et al., 2023), a view that Davids and Araújo (2010) state prioritizes the 'internal mechanics' of the athlete and neglects the role of the environment in

the explanation of behavior. This contemporary view of skill acquisition, which shapes practice task design (and more), taken up by those in this study, is a significant change they made that was helpful to their coaching. Transitioning from practice environments that lack representativeness (e.g., in unopposed practices: cutting at cones in American football or striking dummies in martial arts; Yearby et al., 2022, 2024) to settings that are representative of the demands of the performance environment (e.g., those that include opposed practices with resisting opponents) is a valuable shift in coaching, especially since empirical evidence from an ecological perspective has shown that posture impacts the perception of affordances and the attacker's decision-making (e.g., Esteves et al., 2011).

As mentioned in Section 4.1 above, Figure 4.6 shows that 91.5% either agreed or strongly agreed (an additional 2.1% somewhat agreed) that players should spend more time in representative training environments. Beyond responding that RLD is necessary for practice, an overwhelming percentage of the coaches and practitioners stated their confidence in their ability to design representative training environments increased after interacting with the Emergence online coach educational material (see Figure 4.5). This finding is compelling, as the impact on their professional work was a principal factor investigated in this research study to help learn more about linking theory to practice. Numerous coaches' thoughts and experiences after learning more about representative learning design are shared below to complement the quantitative data. Diego, who works in baseball as a pitching coach, makes an astute observation, stating:

> Traditional practice was hardly practical. Strictly run by coaches in an environment where they were comfortable and had all the answers. Then the game comes, and they get pissed off because they don't understand

> why the team crumbles in pressure situations. Being able to add pressure, anxiety, and game-like scenarios has been crucial for my clients.

Likewise, Sean said, “My decision making regarding practice design has been hugely influenced... Knowing why representative training environments are critical to transfer has been a key element to being confident in using them.” Mickey, who works in Canadian football, seems more assured and energized, expressing the following:

> It has expanded my thoughts around making training and/or drills more representative of situations the athletes will encounter in their sport setting… It has made me aware of some of the limited usefulness of traditional football drills and has me constantly trying to make drills more realistic and applicable in nature… I intuitively knew that trying to make drills as realistic as possible is the ideal, but the online courses helped to provide a framework to implement in order to achieve this goal.

Joey, who works in baseball, saw the value in changing his approach to skill development: “I implemented more time into training that tries to create a representative environment instead of just hitting repetition after repetition of a drill.” Similarly, Jeff explains:

> To put it simply, I have been trying to keep things as game-like as possible. Having too much decontextualized time spent on training does not transfer. For example, throwing to a net is less representational than throwing to a partner, with a hitter standing in and learning how to read the situation unfolding in front of them.

George, who also works in baseball, said:

> My confidence has increased in building representative learning environments… Our practice designs have become much more representative of the game, and we don’t view coaching as a means of “prescribing an answer” but rather designing a practice that is going to promote relevant problem-solving to build relevant skills.

Further, Chandler comments, “I'm much more confident about my plan for helping athletes transfer training to game scenarios. It's not perfect, but there's much more thought process behind the transfer piece now.” Finn, who works in tennis (and as a physical education teacher), adds, "I'm better able to design representative tasks." Zafir, who works in football (soccer), had similar

takeaways: “After attending Emergence online learning, I am now more able to design representative training and help my athletes undergo situations.” In the following comment by Oliver, along with examining the movement problem-solving process differently, it is essential to note that he felt more organized and capable and now sees value in considering how he could set up problems in practice that are representative of what the players are going to engage with during the competition.

> I think in terms of when I observe my teams in the games and in trainings, I look at it a lot differently. Rather than looking at the final result like, [were they] effective, I'm looking at the whole kind of picture around it. What information was my player perceiving? How did they move before the action? Who were the opponents nearby? I think I'm looking at the bigger picture of the part of the play rather than OK did they pass the ball from A to B? [Were] they effective? I felt this [has] improved my analysis skills, which therefore kind of improves my [um] session design because now I'm thinking, OK, what sort of environment can I create to kind of produce that problem in many various ways.

These comments show the perceived value of designing representative learning environments that embed athletes in practice tasks where they can work through the process of solving problems in different ways, assisting them in becoming more adaptable. It is explicitly stated by participants Sean, Jeff, and Chandler and implied by others that increasing task representativeness where problem-solving is promoted increases the likelihood of transfer. Additionally, the notion of athletes “owning” their movement solutions is acknowledged by most coaches. Oliver explains how his movement analysis has changed (more on this in section 5.3.), and he subtly refers to his growing confidence, a coaching change that will be addressed at length in Section 5.1.

Moreover, Gordon captures the significance of situating players in learning environments where information represents competition when he says, “I feel as though my practice activities align with the representative learning design framework. Problems are alive to the athlete. That is, they look, sound, and feel

more like the game.” His ability to express value and impact on his practice after applying the ideas in his professional practice is a meaningful acknowledgement. Gordon adds more by saying, "Before, I may have known about the framework and concepts to a fair degree, but it was not until after continued support from Emergence that I was able to connect the dots and apply them to my craft." Continuing the focus on the information available for pick up, Liam, who works in tennis, added similar thoughts about his experiences by saying:

> I'm coaching an athlete, going up and down the scale or making it representative as much as I can. So, the information in the game has to be present as much as possible, and that's a massive, probably one of the bigger changes. Are there information sources here that my athlete can actually use in this practice activity?... That's the way I look at the tennis game now. Totally different in that before, I thought there was one way of playing, or maybe a few ways of playing it, and [that's] it. That's all you had to do to be a very good tennis player, but I think now, knowing how open a sport it is, and you know, and for players, actually, there's so many, so many ways to actually win a point or hit a ball, it's just opened up my toolbox a lot more, you know.

The two points above and the reflections shared further elucidate the consideration given to the activities that they designed to ensure that game-like information is available in practice (e.g., having an opposition present). The reflections by the coaches from their applied experiences are valuable because the behavior of others influences the ‘technique’ that emerges, and vice versa (Gibson, 1979; Lee, 2011; Myszka et al., 2023a; Navarro et al., 2013; Yearby et al., 2024).

Consequently, it seems as though most coaches felt compelled, perhaps through the inspired confidence that will be further unpacked in the first sub-theme below, to set up problems that were representative of the competitive environment, where players could work through the process of solving ‘alive movement problems,’ challenging them across changing conditions, such as in disadvantageous weather (e.g., muggy or windy conditions or overly bright

sunlight), in their pursuit of more water-like (adaptable) movement behavior (Myszka et al., 2023a). This final comment from Ross sums up the value perceived by many in shifting their practices to represent the demands of competition: “I can’t imagine planning practices any other way now.” In conclusion, the power of using ‘slices of the game’ in practice (Yearby et al., 2022) to ensure learners interact with problems that look, feel, and behave like the sporting environment (i.e., representative; Pinder et al., 2011) was an impactful and valuable learning design principle coaches harnessed in their professional practice.

4.2.3. The Power of Manipulating Constraints

Understanding that constraints, which are central to the constraints-led approach (CLA) and ecological dynamics, act as information that specifies affordances is valuable because coaches can purposefully manipulate them in practice to shape athlete interactions to increase learning and performance (Gray, 2021; Renshaw et al., 2019). Ethan, who works in rugby and Australian football, recognizes this key point when he states, “Viewing sports as a set of constraints acting on a player or group of players has really enhanced my coaching eye… This has been the biggest positive from the Emergence content: practical insight and how to apply the theory.” Gordon expressed the importance of the confluence of constraints shaping behavior when he said, “How I view and analyze/study sport teams and athletes as complex, adaptive and open systems self-organizing under constraints; how perceptions, cognitions, and actions are highly interconnected and support the emerging movement being observed.” Both coaches note that with an increased understanding of ecological dynamics, they are better equipped to analyze emergent behavior. Additionally, hearing and

seeing constraints manipulated, as demonstrated throughout the online courses, seems to have served as a platform for applying the ideas themselves.

Central to the CLA, as noted above, is purposeful manipulation, where constraints such as reduced playing area dimensions or changes to the numerical relations may be made by a coach to destabilize behavior, promoting the search for a more functional solution (Gray, 2021). Constraints can also be manipulated to help athletes explore a variety of ways to organize their system degrees of freedom (i.e., perceptual, cognitive, and motor) to solve similar behaving problems (Hristovski et al., 2006). Careful constraint manipulation can help athletes exploit movement system degeneracy, which is defined as “the ability of elements that are structurally different to perform the same function or yield the same output” (Edelman & Gally, 2001, p. 13763). Further, the timing of practice may be changed to a time of the day when it is raining so players can interact in challenging situations similar to those soon to be experienced. Bernstein (1967) noted that the most highly skilled performance involved the exploitation of available surrounding energy in the environment (for free) to coordinate actions, e.g., variations in forces and friction due to changes in surfaces and weather conditions. This critical aspect of using the CLA is important and cannot be overstated.

Six different coaches are highlighted below, sharing purposeful constraint manipulation as a significant takeaway from the online courses. Goose shared, “Prior to engaging with the material at Emergence, I would constrain to constrain (randomly); now I manipulate constraints with more thought and intention.” Sean offered similar observations: “By having a theoretical understanding of constraints, I feel much more capable and intentional with their manipulation.”

Giovanni mentions, “We're manipulating constraints for a very specific purpose.”

Moreover, Gordon says:

> I view my role not as providing highly explicit instructions as to how an athlete should move in sport, rather as purposefully manipulating constraints as to 'set the table' for which one's relationship with that environment may be enhanced by learning to perceive affordances and successfully act on them.

Likewise, Oliver expands by saying:

> It is now no longer a 'shot in the dark' when I manipulate constraints. I have a greater self-realisation of why 'I need to change this constraint' and the benefits behind it. In the past, maybe my manipulation of constraints was more random than related to the session intention. Furthermore, I feel I am better attuned to HOW the player interacts with these constraints… I feel one of my strengths is my creativity in using constraints in practice. I am able to use a variety of task constraints to construct real game-like problems for the players to interact with.

Liam’s thoughts and ability to manipulate constraints were impacted as well. He shares:

> And even more recently, adding a few more consequences and a bit more anxiety to practice is probably something that I've done the last few months as well, where I felt that I wasn't doing that. And as you know, in a game of tennis, you know there's a lot of consequence. If you miss a shot or something, there's always a consequence. You know what I mean? And you can adapt the scoring system, the court site—you know, there's a lot. There's a lot more now [that] I can play with than I ever thought possible. I'll be perfectly honest with you; I was too rigid in my thinking, you know?

A key takeaway from the online courses, as noted by the coaches above, was being intentional with constraint manipulation, which is helpful for individual learners and those performing as a team to use actions to explore available perceptual information (Renshaw et al., 2019). Meeting the learners where they are can be crucial for them to develop skilled intentionality in competition (see section 2.2.3), assisting them in navigating dynamic performance landscapes. The notion of ‘setting the table', as Gordon mentions, nicely captures a coach setting up activities to assist in this process. For these coaches, it is suggested that they are satisfied and invigorated, knowing they can assist in helping athletes

become attuned to affordances that will expand their movement skill set. In conclusion, something that was impactful and expanded their abilities as coaches was learning how to purposefully manipulate constraints.

4.2.4. Task Simplification: Scaling the Complexity to Meet Individual Needs

The concept of task simplification (directly related to constraint manipulation), where coaches engage in the scaling of constraints, is an important aspect of promoting effective skill acquisition from a NLP perspective (Chow, 2013, 2021; Davids et al., 1999). When coaches avoid task decomposition and instead elect to scale the complexity, they can effectively set up 'alive movement problems' that are representative of the sport (Myszka et al., 2023b), assisting learners in finding a functional fit as they explore individual movement solutions. This principle, alongside the two already discussed, was mentioned by Gordon as a strength he perceived in his practice. He listed the following:

> (a) designing and scaling more alive problems to be solved by teams and for individual athletes over varying timescales through purposeful constraint manipulation, representative learning design, and task simplification, and (b) understanding how perceptual information (detected and exploited for guiding movement) is lawfully generated by the performer-environment system and amplifying information for supporting subsequent action.

When scaling the complexity of practice tasks to meet individual learner needs, representative co-design (Woods et al., 2021c; Yearby et al., 2022) is a helpful idea to use. Incorporating suggestions from the athlete's perspective is an easy way to design appropriately challenging activities. Carter, who works in tennis, mentioned the following as a new strength he perceived in his professional practice:

> More flexible in approach with athletes and moving towards more co-designing. Using the athlete's experience of training and matches has

> really helped us develop the programme. Players have an increased sense of belonging and readiness to bring ideas to each session.

Maverick, who works in strength and conditioning and baseball, had enlightening observations, saying, “Now I feel empowered by the practice design to allow the practice to flow, and for athletes to be co-creators of their own learning and feedback.” Akin to Carter and Maverick’s feedback, Jerome, who works with Olympic athletes in several sports, expressed, “It has totally expanded my way of collaborating with the athlete and taking their thoughts and giving them the opportunity to shape practice.” In his comment above, Gordon captures the importance of scaling the complexity of practice tasks when he highlights the individual (performer)-environment system. This feedback is critical because it shows his understanding of interacting constraints, where information can be amplified, helping to shape functional behavior. Moreover, the comments from the other coaches portray the value they perceived in involving athletes in practice task design, known as representative co-design, which was discussed in Section 2.3, allowing them to help scale the complexity (increase or decrease the difficulty) of the activities. It seems clear that understanding ecological dynamics, which emphasizes the athlete’s knowledge of the sport (Gibson, 1966; Renshaw et al., 2019; Yearby et al., 2022), inspired them to make the simple shift towards a more learner-environment-centered approach.

4.2.5. Finding Value in Functional Variability

Of the 47 coaches and practitioners involved in the survey, nine specifically mentioned the value of movement variability. Sixteen others expressed the importance of athletes organizing variable movement solutions to problems they encounter in sports. These comments were recognized as changes in their coaching and were identified as helpful and a strength of theirs, specifically their ability to set up ‘alive movement problems’ for athletes to work

through the process of solving with the goal of adaptability. Seven of those coaches and their thoughts are highlighted below. Mateo reflects on his previous coaching perspective compared to how he views it now by saying, “When I designed some tasks, I thought about 'give them solutions', now, I design thinking in their action possibilities and their emerging solutions, but theirs.” Similarly, Walker, who works in lacrosse, adds:

> I no longer default to there only being one solution to something... I am fine with them finding different solutions than what I thought was the correct way… Each athlete is completely physically different and that means they need to find solutions that work for them.

Each of the thoughts above emphasizes the importance of owning their movement, connecting to the world and its opportunities, authentically solving movement problems based on their action capabilities, and becoming adaptable (Chow et al., 2022). This is valuable because, with the freedom to explore, metastability can arise (i.e., where two or more behavioral opportunities emerge from the interactions, where the system has the capacity to switch between the weakly stable solutions; Gray, 2022; Kelso, 2012; Myszka et al., 2023a). Maybe unknowingly, it seems as though this quality was valued, which led to pedagogical changes by other coaches, including Gordon and Marvin, whose thoughts are captured below. Gordon offered:

> How I view the role of the athlete: a transition from learning an ideal technique through rote repetition to wayfinding/problem-solving - learning to adapt movements as solutions to changing problems through the refinement of perception and action capabilities.

Marvin acknowledges something similar: “Having more of a focus on creating athletes who are problem solvers rather than ones who perform movements or drills with perfect technique." While metastability was not explicitly stated, the need for problem-solving was, indicating its perceived value. Moreover, Giovanni

lists several strengths he has perceived in his professional practice, with the second observation aligning with thoughts shared by others.

> Those listed were: (a) the ability to observe and design small-sided games with creative constraints; (b) a good understanding of what players may be struggling with and how activities can be designed around that without giving them one specific solution; and (c) the ability to go off-script and go down different directions within a practice based on what is emerging in front of us.

The notion of movement variability was also prioritized outside of sports skills. Hayley, who works in strength and conditioning and football (soccer), had this to say regarding the weight room: “Applying ‘repetition without repetition’ in weight room settings... understanding that sport movements vary with each repetition (and that given lifts are beneficial to athletes when they, too, have greater variability)". From physical therapy, Peter added: “Variability is embraced, and creative solutions to movement problems can be embraced... It also provides an exploration of a problem rather than providing a ‘fix’.” These responses show increased confidence and the willingness and desire to shift the focus of practice to one of problem-solving, assisting athletes and patients to become more adaptable movers. This section provides a great example of the noticeable patterns in the data between the theme of *Coaching Changes (Harnessing the Performer-Environment Relationship),* which underpins this subsection, and the sub-themes of *Ability (Confidence Supports Application)* and *Providing a Platform for Adaptability (Developing Better Problem Solvers)*. I will expand on perceived confidence, problem-solving, and adaptability in sections 5.1.1 and 5.2.1.

4.2.6. Educating Their Search

The fifth key principle mentioned earlier is the *provision of informational constraints* (e.g., instructions and informative questions). These communication strategies, which are instructional constraints (Renshaw et al., 2019), can be used by movement professionals to harness the notion of becoming a *wayshower*

(i.e., those who guide or educate the search for the athlete's wayfinding process; Woods et al., 2020a). *Wayfinding* is viewed as a purposeful, intentional movement that takes an individual from one region in a landscape to another (Woods et al., 2020a). For coaches in the study, this seemed to be a strength they perceived after applying ecologically driven communication strategies in practice.

For example, Diego stated, "Being able to guide the attention of the athlete and influence their intentions... asking the athlete deeper questions instead of just giving them the perfect answer." Likewise, Roy said a coaching change he noticed was "the ability to ask better questions and help guide athletes to explore." Liam went on to say a notable perceived strength of his craft was "more interaction with athletes, better questioning style." From physical therapy, Peter added, "It has made me rethink how I interact with patients, from the language used and directions given to the design of a treatment session." Oliver offers related thoughts by saying:

> So, after engaging with the content and from what I learned, I felt more in control of how I can manipulate the environment through constraints, representative learning design, and then also through my own interactions with players, not just in terms of [giving] them explicit information but in terms of directing their attention and their intentions—my questioning as well.

Along with others acknowledging the effective use of NLP principles in their practice, Giovanni conveys the importance of understanding the theory to support using the principles, including guiding athletes' search for information, saying:

> Applying the five principles of a nonlinear pedagogy, so we're [purposefully] manipulating constraints, we're using external focus of attention. All those things have come as a result of [me] understanding the theory, and if I didn't have that understanding to guide kind of how I'm delivering practices, the things we're doing would be nowhere near as effective as they could have been.

For Zafir, and similar to thoughts shared by other coaches above, the online material supported a change in his ability to guide the players he partners with:

> First of all, this type of course helped me to understand a lot of new concepts. Also, it helped me redefine some concepts. More understanding in this area gives me the ability to guide or encourage my players.

With the goal of guiding the athlete's (or, in Peter's case, patients) exploration for individual-specific, functional solutions to the problems they encounter in competition (Button et al., 2020), the seven participants above all captured the value they perceived in the changes they made to their practice, which included questions to educate the learner's attention and statements made to influence their intentions. The ecologically driven communication strategies are explained in Section 2.2.5 and are central to ecological dynamics. Moreover, while it was not explicitly stated, their comments suggest perceived value in the coach-athlete system, where coaches serve as *wayshowers* for each athlete's *wayfinding* journey (Woods et al., 2020a). Interestingly, the online material seemed to educate the attention and intentions of coaches towards guiding the wayfinding of athletes, which supports an understanding of how an ecological approach could be used in coach education (Wood et al., 2022). Before addressing two sub-themes that support the primary theme of coaching changes that harness the power of the performer-environment relationship, an intriguing observation concerning engagement and enjoyment is discussed.

4.2.7. Practices Are More Enjoyable

Intriguing, although not surprising, with NLP embracing a learner-environment-centered approach (Chow et al., 2016; Yearby et al., 2022), along with exploration and movement variability (Button et al., 2020), coaches and athletes enjoyed the training more than they had with alternative approaches. George stated, "We have found our players to be much more engaged in practice

because of its level of challenge. It's allowed for there to be some autonomy in the choosing of challenges, which continues to increase the engagement/fun." Declan goes on to say, "Greater athlete interaction and engagement, possibly due to their excitement and enthusiasm for the tasks that are employed (encouraging exploration of movement, etc.)." Maverick highlighted similar takeaways, saying, "Something as simple as obstacle tag has taken on a whole life of its own in our program, and we are constantly evolving it and creating opportunities for kids to develop (and have a ton of fun)." Harry, who works with collegiate and professional athletes, offered, "The athletes I work with and I (as coach) enjoy sessions more." It is important to illuminate that Maverick mentions children, and Harry works with advanced movers, showcasing that athletes of all levels find value and enjoyment in having the freedom to explore. Jackson explicitly states the impact on movement preparation: "It has very positively changed our prep work for training sessions. We very rarely do just dynamic stretching lines now. We move in as many ways as possible, we problem-solve, and we have fun doing those things… They enjoy their training sessions more." Anton, who works with Olympic handball, observed the players having more fun and made a point to share that he, as the coach, is as well. Anton says, "My practise is much more fun and motivating for my players now (for me too)." Similarly, Giovanni expressed, "I felt happier as a coach, and practices are more enjoyable… Sessions are much more positive." When interviewing Giovanni and after asking him if he had noticed any changes in the athlete's movement skill set through the purposeful manipulation of constraints and discussing the success his team had over the year, he offered something similar to those above, saying:

> But I'm sure that the way we practice and the way that ecological dynamics has informed what we do—I'm sure that's a huge part of it, and the players have actually said that themselves, which has been really interesting—so without me saying that, they've really attributed it to the way we practice

> and very consistent themes such as the fun that they keep saying that we've had during the year, the engagement factor, and the fact that they're consistently making better decisions.

Steve, who works in MMA, also points out the increased engagement, and like Giovanni, he observed skill changes, saying, “I have been having more engaged students and seeing more growth in skill.” Collectively, these observations from the coaches’ lived experiences convey a powerful message, suggesting that changes to their pedagogical approach, in this case, harnessing a nonlinear one underpinned by ecological dynamics (Chow, 2021), seemingly set the stage for greater enjoyment and more interactions. NLP promotes individual search and exploration, where constraints are manipulated to meet the learner's needs and more time is spent on representative tasks (e.g., 2v3 in a confined space). Furthermore, this contemporary approach to skill acquisition encourages problem-solving (unique to each individual). For example, a running back (RB) in American football might interact with the ‘same’ 2v3 movement problem in open space (the RB has the ball with a lead blocker against three defenders) with encouragement to see how many ways they can solve the problem. Constraints may be manipulated ever so slightly from rep to rep (e.g., varying the interpersonal distance between the players to start the activity, the speed of entry, and location on the field); in doing so, with the RB's intention of solving the problem differently, they may bounce the ball to exploit the gap near the boundary or cut back to actualize the emerging gap between defenders. This reconceptualized notion of problem-solving (Myszka et al., 2023b) promotes adaptability and could be a central factor for athlete enjoyment, as noted by many coaches above. In conclusion, their comments highlight the value perceived from the online delivery of ecological dynamics and related coaching material, further answering the question of perceived impact.

4.3. Conclusion

In the sections above, overwhelming evidence reported by participants showed a positive impact on the professional work of sports coaches and practitioners after interacting with Emergence online learning opportunities. This was evidenced by many explicit statements and, more importantly, changes made to their coaching, illustrating the theory-practice link. The reported changes embraced the performer-environment relationship and emerged across participants working in different sports and with learners of varying levels of skill (more on this in Chapter 7). Since the Emergence educational material is underpinned by ecological dynamics and NLP, it was interesting to note that the reported changes made by coaches and practitioners were aligned with the five key principles of NLP explained in Section 2.2.5. Furthermore, recent studies addressed in Section 2.5 (see Buchner & Plessl, 2022; Driska, 2018; Koh et al., 2017; Sackey-Addo & Pérez, 2016; Santos et al., 2019) suggested that coaches had positive experiences with online learning opportunities. The findings from the current study, reported in this chapter, show that this was the case for the coaches in this study as well.

As addressed in Section 2.5.1, there is a paucity of research investigating the strengths and weaknesses perceived by coaches and practitioners in their professional setting after applying what they learned from online resources. The findings discussed in this chapter, such as the newfound or increased ability to design representative learning environments (see section 4.2.2) or purposefully manipulate constraints (see section 4.2.3), contribute to an improved understanding of the effectiveness online learning material has on applied practice. Therefore, it is clear that after interacting with ‘and applying’ ideas from the Emergence online courses, which are underpinned by a contemporary

approach to skill acquisition (i.e., ecological dynamics), the sports coaches and practitioners felt empowered to assist the individuals they work with to move more skillfully. Two sub-themes that support the principal theme of *Coaching Changes (Harnessing the Performer-Environment Relationship)* are presented and discussed in the following chapter.

Chapter 5: Increased Coaching Ability Leads to a Platform for Athletes to Evolve Their Skills

5. Introduction

Chapter 4 highlighted multiple changes coaches reported making in their practice, inspired by their interactions with online educational material underpinned by ecological dynamics. The changes included embracing representative learning design (RLD), purposeful constraint manipulation, simplifying practice tasks to help athletes develop relevant information-movement couplings, appreciating functional movement variability, and the provision of informational constraints, such as asking questions and making statements to guide exploratory behavior and skill development. These changes, plus the increased enjoyment perceived by coaches who employed a contemporary approach to skill acquisition and athletes who experienced it in training, collectively demonstrate the value derived from the online educational material.

In this chapter, two sub-themes are presented and discussed titled *Ability (Confidence Supports Application)* and *Providing a Platform for Adaptability (Developing Better Problem Solvers),* both of which are underpinned by the principal theme outlined in Section 4.2 titled *Coaching Changes (Harnessing the Performer-Environment Relationship).* The first sub-theme is closely linked to the principal theme of 'Coaching Changes' because it was evident that confidence was a key factor in coaches' and practitioners' ability to make changes in their practice. Of the 47 participants, 19 explicitly stated their confidence increased after interacting with the online material, and several (as will be shown in section 5.1.1. below) reported that the information provided the 'why,' which served as a starting point or gave them the *ability* to apply ecological ideas in their professional practice.

The second sub-theme is closely related to the principal theme of ‘Coaching Changes,' which was addressed in Section 4.2, because the notion of

developing better problem solvers from an ecological perspective is made possible through embracing the performer-environment relationship. This important ability emerged for the coaches and practitioners, as was shown through the coaching changes explained in the previous chapter. Moreover, the perceptions from numerous coaches (e.g., Steve, Ethan, and Nathan's comments in section 5.2.1) delineate the value placed on ownership, adaptability, and problem-solving. These prioritized changes were specific to creating learning environments where athletes are embedded within 'alive movement problems,' where creativity and skill could flourish.

The two subthemes will be unpacked in Sections 5.1 and 5.2 below, building upon the strengths perceived by the coaches and practitioners in their professional practice, which included, but were not limited to, their ability to design representative learning environments (see section 4.2.2), manipulate constraints in training (see section 4.2.3), and educate the athlete's search to facilitate the emergence of skillful behavior (see section 4.2.6). These strengths illustrate the link created between theory and practice, helping to answer the research question.

5.1. Coaching Changes Sub-Theme #1: Ability (Confidence Supports Application)

The first of two sub-themes is titled *Ability (Confidence Supports Application).* Through explicit statements and alluding comments, it became clear that the coaches and practitioners were more confident, leaving them more equipped to apply nonlinear pedagogical (NLP) principles in their practice after interacting with the online resources. For some, an expanded understanding of ecological dynamics and NLP opened up new opportunities (e.g., Sean in section 5.1.1), especially for practice design, and for others, the online learning material

influenced change in some areas of their practice while validating what they were doing in other areas (e.g., Jesse in section 5.1.1). A definition of the sub-theme is presented below, followed by findings that support its development.

Ability (Confidence Supports Application)

A deepened understanding of ecological dynamics was integral to inspiring confidence to support the coaches and practitioners in attempting to apply ecological ideas in their professional practice; for others, it validated how they were analyzing movement, designing practice or training sessions, and communicating to assist in a more specific application of the ideas in training. Numerous times, as illustrated in Section 5.1.1. below, participants indicated that the information provided clarity and structure and offered a starting point for exploring. In particular, the spoken and demonstrated (on video) examples were critical in providing the needed direction to aid coaches in making changes in their practice. This finding is akin to the one made at the end of Section 4.2.6 (i.e., an ecological approach is just as important for coach education as it is for coaching athletes). The online learning material was pivotal in guiding their search for better practice by providing structure and clarity, helping to educate their intentions and attention. Furthermore, the online courses, coupled with other learning opportunities (e.g., reading books and online journal articles), gave rise to even more confidence when applying the ideas in their professional setting.

5.1.1. Confidence Gives Rise to Ability

The notion of increased confidence was explicitly expressed by 40.4% of coaches and practitioners (19 of 47) after interacting with the online material, as acknowledged in numerous statements below. Collectively, these thoughts convey that confidence impacted their ability and suggested that a clear understanding of the theory supported their practical application. Anton stated, "I

feel much more confident now because I have a clear rationale for why, what, and how we do it… It increased my confidence in my ideas for putting theory into practice." Desmond offered feedback about his experience interacting with the online courses, saying, “I had previous experience and knowledge, but this was clear, concise, and easy to understand… It has helped me be a better coach through an understanding of the complexities that exist in a sporting environment.” Roy also felt the content was delivered clearly: “With a clearer view of the major concepts and principles, it allows me to design more effective environments for my athletes.” Jerome captured his experience by saying, “Very helpful, being the best resource in ecological dynamics. They give practical examples from their experience in coaching.” Goose noticed his increased ability to design learning environments: “I have noticed that my ability to design training/learning environments has greatly improved.” Sean's comments indicate that he has been challenged to think, influencing his practice design and giving him the ability to make changes to his practice. He says:

> It has been helpful in distilling abstract concepts and making certain terms far more understandable. Emergence has been huge in helping connect different aspects of the files together and helping me realize how they work together… The additional understanding has given me more confidence to pursue these ideas in practice… It has given me pause on my old practice design and forced me to reconsider what once might have been considered a for sure truth. I approach the warm up differently now, and I also consider the individual athlete in a much different light—form of life etc. I now almost demand defenders in every situation, and make use of time constraints much more.

Moreover, Goose confirmed the impactfulness of the online education material after applying the ideas in practice, saying, "Emergence and ‘Underpinnings’ specifically have helped me understand ecological dynamics principles to a greater degree, which has allowed me to apply these concepts more effectively; for example, constraint manipulation and representative learning design." Nathan had a profound experience, explaining:

> Before Emergence, I had a scholarly understanding of the principles of ecological dynamics. After working through several Emergence courses, scholarly knowledge evolved into one of fluency and functionality. I not only understood the vocabulary/theory but it became a part of who I was becoming as a coach. I was attempting action these principles within my own craft with youth athletes. My understanding, as a result, was deepening significantly... As previously stated, several worksheets, demonstrations, and anecdotes experienced throughout the course were indispensable in helping me take my first steps.

Furthermore, Zafir stated, “The Emergence online learning material increased my confidence when applying constraints in practice.” In addition, Oliver said:

> I suddenly felt kind of more organized, and I had a better idea of how to construct practice to create learning opportunities for players, whereas before I felt very lost, and maybe I was adding constraints or I wanted to kind of help players be more aware of something in their game, but I didn't know how to do that [other] than being explicit with them… Within my own coaching intentions, like before, when I kind of entered into the courses, I felt that the session design was OK [when I prepared it]. But then, once that session started, I struggled—really, I struggled a lot—in terms of how to manipulate it. Umm, but now I feel a lot more confident. I'm a lot more assured of being able to observe practice, be creative myself in terms of noticing certain patterns or what players are interacting with, what problems they're confidently and effectively solving, and how I can kind of, uh, play with that to test them more and make it more challenging or challenge one specific part of their skill. And yeah, I feel a lot better in terms of doing this; I'm kind of more assured of my role within the session during the 90-minute session.

Moreover, Steve mentioned the noticeable confidence in his practice while also acknowledging how the increased understanding impacted how he communicates with athletes, stating, “After taking these courses, I feel more confident in sticking with ecological theories when session planning and discussing training plans with my athletes.” Felix, who works in baseball, was greatly impacted by the online education material, saying, “Before engaging with the online learning material, I did not know how to put these ideas into practice. Afterwards, I figured it out.” Arthur had similar experiences as Felix, stating, “It has helped me make sense of some pretty dense concepts and explore their application in practice.” Akin to what Felix and Arthur shared, Walter, who works as a strength and conditioning or athlete development coach, reported, “It gave

me better knowledge and the ability to apply the ecological approach." Jesse was heavily influenced as well, proclaiming:

> I was already deep into the independent study of ecological dynamics. I remember thinking, Man, I wish I had started with this. It would have saved me a lot of time… It has reaffirmed and consolidated my thoughts and allowed me to create a process that works.

Carter shared interesting and insightful experiences, saying, "The online material has given me confidence in the framework and a starting point to try... Through the Sport Movement Skill Conference (SMSC) 2020 and 2021, my understanding of ecological dynamics really moved forward and allowed me to then engage with research papers and academic books in the area." Arthur said, "It takes heavy academic concepts and makes them easier to understand... I was already pretty confident, but the material strengthened my confidence levels." Dante acknowledged:

> I would say that since interacting with Emergence online material, I've become more confident in applying ecological dynamics principles across a broader range of environments… Emergence more than anything has reassured me of notions and extensions from previous material (texts, research articles) that I've come to in my own practice.

The latter points emphasize how critical the online education from Emergence was in growing their confidence and understanding, which helped them glean more from other learning opportunities. In this case, it served as the foundation for Carter to be able to engage with journal articles and books that can sometimes be a bit inaccessible to those unfamiliar with scientific language. For Arthur and Dante, it further supported their understanding and use of the ideas. Another point worth accentuating here is that the art of coaching is ongoing and ever-changing, much like the skill adaptability of athletes. Finally, Finn elaborates, saying:

> Yeah, [I'd say I] definitely increased in confidence because, [um] when you see how other people are doing it and it kind of [has] similarities between the way you've been trying to do it or the way you've been doing it, it kind of like, I [suppose], it kind of reinforces, [or] kind of backs up your ideas or

> whatever that you had and [it kind of] gives you more confidence moving forward, so you're like, I'm not the only one approaching it this way. And there are these [similarities]. There might be these things I could do better, but I am kind of in the [right] wheelhouse, or like in the right area [in] kind of approaching it that way.

Finn makes another interesting, although not surprising, statement about his experiences making ecologically driven changes to his practice after engaging with the course material while concurrently joining the monthly Movement Meet-Up (MMU) calls (see section 3.1.1. for more detail):

> The Movement Meet-Ups were amazing, and I took so much from them… What I found useful was if you were going through the content, if there was one of those Movement Meet-Ups coming up that you were able to ask questions kind of as you were reading, it was quite helpful… Yeah, no, definitely like seeing how others [do it], even if it's in sports that are completely different from your own sport, [or] seeing how people like, maybe skillfully manipulate constraints or kind of design in affordances is quite, um, it definitely did help, seeing examples from different sports, even if it's not your own… Or maybe even some of the struggles that others have that you're kind of able to resonate with them. And it kind of helps you know that this is kind of normal, and this is what other coaches are going to feel like when they're [applying] the approach too. So, like, it's not going to be perfect [every time]. You're going to have to make changes.

To complement what Finn communicated, and in addition to what he shared above, Dante adds, “Emergence has provided me a community of people who I feel as though are fellow travelers and I can converse and learn with regardless of background.”

In conclusion, the numerous thoughts and experiences shared above elucidate that the online courses gave them the confidence they needed to apply the ideas effectively in their learning environments, while others expressed that the education material strengthened their confidence or confirmed what they had already been doing. Specifically, the newfound or increased confidence supported the coaches' ability to manipulate constraints, design representative learning environments, and effectively communicate with athletes. Designing practice plans, in-session coaching adjustments (i.e., manipulating constraints),

and educating the intentions and attention of athletes can be difficult; it's clear that confidence acts as a foundation for coaches to comfortably and intentionally make decisions in their professional practice. Moreover, as noted by Finn and Dante, the interactive opportunities (e.g., MMU and The Movement Academy cohort calls), analogous to CoP (see section 2.4), are groups of individuals with similar interests that can exchange ideas to solve problems with a common goal in mind—in this case, to help develop more adept movers and lifelong lovers of movement. These interactive opportunities were stated as being very helpful, assisting coaches in understanding more about ecological dynamics and the application of the ideas in their professional practice. Finally, the online course material provided a foundation for coaches to support them in positively engaging with academic material (e.g., online journal articles).

5.2. Coaching Changes Sub-Theme #2: Providing a Platform for Adaptability (Developing Better Problem Solvers)

The second sub-theme is *Providing a Platform for Adaptability (Developing Better Problem Solvers).* The patterns that make up this sub-theme have numerous similarities to the main theme of coaching changes, specifically, prioritizing 'alive' and representative movement problem-solving. Moreover, responses routinely mentioned the importance of athletes and patients having ownership and the freedom to explore various ways of solving changing movement problems based on their unique capabilities. A definition of the sub-theme is presented below, followed by findings that support its development.

Providing a Platform for Adaptability (Developing Better Problem Solvers)

There is a greater understanding of and focus on the athlete-environment relationship, and coaches and practitioners are now investigating the problem-

solution dynamics. Because of this, priority has been placed on embedding athletes in training environments where they can work through the process of solving changing movement problems to become more adaptable in games. Moreover, individuality, creativity, and movement variability are now viewed as important qualities, and coaches feel more comfortable purposefully manipulating constraints to meet individual needs. With an evolved view of skill acquisition and approach to practice design, positive changes have been observed in the movement behavior of athletes. Different solutions are emerging as functional fits for the movement problems athletes face.

5.2.1. Prioritizing Adaptable Movement Problem Solvers

The ability to solve the most difficult problems emerging during sports is one of, if not the most desirable, qualities athletes look to achieve. As discussed in Section 2.2.4 and suggested by existing research in ecological dynamics (e.g., Renshaw et al., 2019; Yearby et al., 2022), if coaches assume the role of activity designers or problem setters, they can assist athletes in this endeavor. As mentioned, a noticeable result (change in coaching) that was overwhelmingly present (hence the reason it is a supporting sub-theme) in the coaches' and practitioners' professional practice was their ability to design or set up changing problems to assist athletes in becoming more adaptable. Below, eight individuals were selected to emphasize new perspectives and changes made to their learning environment design after interacting with the online education material.

Steve says, “Getting away from a prescribed movement as a goal and valuing more the problem-solving process of movement.” Ethan shares, “Adaptability is so important, and creating a safe space where errors are embraced is so important for growth.” George offers a similar perspective, noting, “Emergence online learning material has been very helpful in outlining a potential

way of creating practice differently, and viewing skill differently. It's revamped our thinking about how we develop players." Nathan mentioned, "I find myself trying to craft learning environments for my players where they are viewed as problem solvers - where they can explore various solutions." Zafir offered his perspective, which is a noticeable shift in his thinking that he says helps him during practice:

> I learned from the online course with you guys that the coach has to be the problem setter and the players have to be problem solvers, so this concept really helped me when I do the daily session.

Gordon gleaned a lot from the online education material and was able to make changes to the practice activities, saying, "I am better prepared to manipulate constraints so as to set up individual problems to be solved by each individual athlete with the knowledge of how to analyze behavior in an ecological approach." This is an empowering statement by Gordon, and from his experiences, it seems as though he feels more adaptable as a coach. Additionally, there is an underlying sense of accomplishment in his statement. He goes on to note changes he has perceived in his practice: "How I view and analyze/study sport teams and athletes as complex, adaptive and open systems self-organizing under constraints; how perceptions, cognitions, and actions are highly interconnected and support the emerging movement being observed." Gordon's statements describe a recognizable change, impacting his practice design and how he coaches, enabling him to provide a platform for adaptability for the athletes he works with in training. Oliver revealed similar observations to Gordon, sharing a lot about his ability to challenge athletes to become more adept at solving problems:

> I now think more about the problems my players face and how I can design sessions that present these to the athletes and require them to solve them. This is different from the past, where I thought more of "concepts to teach," where the focus was more on them learning "my solution" rather than interacting with the problem more autonomously (yet guided) and developing their own unique novel solutions…. I feel I am better aware of how to dial up/down the representativeness through the constraints I manipulate and the reasons WHY I need to do this. Furthermore, I feel I

> am more attuned to how my players act in the environment and how modifying its complexity can challenge them or nudge them toward other solutions… I feel my own coaching intentions are now more centred on guiding the player to be more adaptable and efficient at solving problems in a variety of ways, rather than producing the one solution that I believe would be best to solve this problem.

Oliver adds more, this time highlighting the importance of athletes expressing individuality:

> I think by just presenting different various problems, I think of how it kind of helped to kind of push the individuality of the player rather than before, it was OK, this player plays in this position, they must move and act in this way because [of] how a typical player acts in this position. Whereas now, like for example, I might have a defensive midfielder who [is] stereotypically big, and strong, and tall, but now I have like a smaller, quicker number #6 defensive fielder who can solve the same problems in their own unique way and still be effective, and so, uh, yeah, it's about kind of nurturing the individuality of the player to kind of push them to solve the problems in their own way rather than before.

These changes were observed by professionals other than sports coaches. Peter, who works as a physical therapist, elaborates:

> So for me, the change was basically instead of looking for some idealized movement, [um], I was much more willing to see some variation in how people moved and how they were trying to really solve their current movement problem. So whether it was walking, getting up from a chair, or negotiating some obstacles, I was no longer looking for this perfect movement solution.

Threaded throughout the participant responses are new or further solidified perspectives on creating learning environments that encourage athletes to explore, promoting their ownership and individuality. Moreover, there are pronounced changes where coaches and practitioners are becoming problem setters or activity designers who manipulate constraints, as Gordon mentioned, to 'set the table,' deepening the relationship between the individual and the environment. The notion of affordances and how an athlete can effectively act on the opportunities were also explicitly acknowledged by Gordon, and the individual-environment relationship and the idea of problem-solving were explicitly stated or implied by the others. Overall, the responses highlighted the

importance of adaptability, from athletes in sports to patients in physical therapy. In conclusion, this suggests that the value perceived from the online material was high, positively impacting how the coaches and practitioners applied contemporary skill acquisition ideas in their daily practice.

5.2.2. Increased Movement Skill Set

There is a great sense of accomplishment and satisfaction for movement professionals when the athletes they work with are more adaptable in competition after spending countless hours working to refine their craft in practice. For example, in Section 5.2.1, Oliver described improvement by highlighting individuality and creative movement problem-solving. In the following paragraphs, several additional observations from coaches are featured that illustrate the changes they noticed in their athletes' abilities after applying ecological ideas to their practice. Zafir, who works with both youth and more advanced athletes, mentioned:

> They do more scanning, they now see more targets. They also, if I can say, filter what's important. They can [uh] decline any noise or any non-relevant information, and they can pick the information in the environment. So that's really helpful for the athletes you know; in the competition, there is not a lot of time, not a lot of space… I noticed that the athletes have better decisions—faster decisions, if I can say [alive] decisions during the game.

Liam, who works with younger tennis athletes, adds:

> I definitely have seen different changes in movement because it hasn't been one movement repeated over and over again, you know… I just think that by allowing them to take ownership themselves, maybe a bit more I've seen their skill set definitely improve because they're hitting a lot more different shots—different strokes.

Likewise, Gordon, who works with professional athletes, shares, "The goals are to develop dynamic sports teams and players, and I have experienced pleasant success and changes to perception and action capabilities by both the team and

players.” Oliver, who works with more advanced athletes, shares his observations:

> If the intention is to progress the ball, then maybe the stereotypical position, [the] stereotypical action of that player would be OK; we'll play that pass in one touch, but now [the player] can solve it in different ways by making lots of touches to take on an opponent, and still progress the ball, which is still effective in progressing the team up the pitch… Definitely becoming more adaptable and making [it] harder for the opposition to anticipate their behaviors.

Like Oliver, Jackson, who also works with advanced athletes, had similar experiences, saying, “The athletes I work with are better problem solvers." Giovanni, who also works with more advanced athletes (including some professionals), expands on his experiences, saying:

> Observing skillful interactions and players adapting right in front of me affirmed this was the right path to take… So this has been, for me, one of the most enjoyable and satisfying kind of after-effects of being completely bought into this framework. And you know whether it's [enhanced] dexterity, players being far better attuned to ways they can create advantages on offense or neutralize the offense on defense. On the flip side, um, players becoming way more adaptable and actually having the confidence to um go off script and not run a set play… Players improved at a far greater rate than when I focused on mechanics and on-air coaching.

Key to note from Giovanni’s experiences is the theory-practice link. Similar to the observations made in Section 5.1.1., the notion of a framework guiding application is clear. Jesse, who works with developmental athletes, had experiences like the coaches working with more advanced individuals: “Our students learn faster. The learning sticks better (because the words don't get in the way). Their training transfers to the game better (the less they "think" the better they play). The skills they develop withstand psychological pressure.” Jesse’s comment about words not getting in the way is interesting and implies that he has learned from the online courses that the value of guiding one’s search can be more powerful than telling them how to move, potentially inundating the athletes with coach-identified instructions that prescribe to one specific model.

Peter frames the changes he has noticed differently, which aligns with the idea of moving away from prescriptive movements, saying, “I have seen improved outcomes in my patients by not being as prescriptive and embracing variability. It gives me a framework to reframe what traditional physical therapy would call an impairment, to a movement problem to solve.” Peter suggests that the notions of variability and problem-solving set the table for improved outcomes. Finally, Desmond, who also works with professional athletes, simply proclaims, “Allowing better learning outcomes."

This section offers observations from coaches and practitioners that describe the changes they observed in the athlete’s movement skill set, which included increased adaptability. Moreover, it is essential to note that increased skills occurred for athletes ranging from youth to professionals, further demonstrating the impactful application of ecological dynamics and NLP principles. The value perceived from the online learning material is an underlying message, as evident in the numerous comments above from coaches who noticed the athletes they work with moving more skillfully. The observations made by coaches were primarily centered around the power of the athlete-environment relationship (Gray, 2021), the processes of perception, cognition, and action (viewed as inextricably linked interacting elements of one integrated movement solution; Myszka, 2023b), and the importance of guiding an athlete’s search. Moreover, the comments seem to insinuate that guiding a learner’s search for functional movement solutions is preferable to telling them what they need to do. In doing so, the athlete’s knowledge of the environment grows and, subsequently, how they skillfully behave within it (Gibson, 1966, 1979; Renshaw et al., 2019). In summary, observations from the lived experiences of coaches in this section, along with others above (e.g., Giovanni and Steve’s comments in Section 4.2.7),

demonstrate how the ideas were applied in their specific learning environments, showcasing the perceived value of the online material and answering the research question.

5.3. Additional Value Perceived After Implementing a Contemporary Pedagogical Approach in Practice

To further address the perceived value coaches and practitioners perceived after interacting with and applying NLP ideas in their practice, additional noteworthy observations supported by the principal theme of “Coaching Changes” and the sub-theme of “Ability” are shared below. The first helpful takeaway implied by many and explicitly stated by three is having patience when athletes work to become better movement problem-solvers. This is not a surprising observation since NLP views learning as nonlinear, occurring at different timescales (Chow et al., 2016). What this means is that nonlinear dynamical systems do not progress in a linear manner; rather, there are sudden jumps, pauses, and regressions (Button et al., 2020). Moreover, the interacting constraints significantly shape the emerging IMS as the learner (e.g., athlete) adapts to the demands of the performance context (Chow et al., 2016; Myszka et al., 2023b; Newell, 1986). Therefore, if learners are improving at different rates of learning, then patience for coaches would be deemed a positive attribute. Maverick comments:

> Patience, for sure. Understanding and applying ecological dynamics has given me the patience to let the athletes and environment "work" and not feel the need to verbally instruct or correct. In turn, this has given me an opportunity to pay closer attention to nuances of the training sequence, and think about changes to rules, equipment, tasks, and feel more attuned to practice. In the past, practice felt like a panicked attempt to ensure athletes received enough feedback/correction that I felt constantly out of time, exhausted, and overextended. Now, I feel empowered by the practice design to allow the practice to flow and for athletes to be co-creators of their own learning and feedback… It has been very helpful.

Likewise, Jaylen added, ”More patient with skill development.” Walker concluded, “I am required to be more patient and let them learn their way. I do not get as upset when they do something ‘incorrect’ because I am seeing that their are a broader range of solutions.” This comment from Walker has similarities to what he stated in Section 4.2.5, where he elaborated on the importance of functional variability and athletes owning their movement solutions. As athletes are “finding their way,” coaches can clearly see value in guiding their search (see section 4.2.6.), and patience, as expressed by Maverick, Jaylen, and Walker, is important to consider as coaches.

The second helpful takeaway derived from the online content was more implied, with numerous coaches suggesting that they are encouraged to think about things differently, reflecting on their professional practice. These ‘things’ consisted of ruminating about how skills emerge, designing practice activities, considering how practice time will be used, the power of the individual-environment relationship and the interacting constraints that shape behavior, and a reconceptualized view of their role as a coach. The following comments have noticeable similarities to other sections (e.g., section 5.2.1); however, the following thoughts specifically capture changes in how coaches view skill development, activity design, and other thoughts about how they can better assist the athletes they train in their professional practice. Reflecting on the usefulness of the ideas he interacted with online, Chandler said, “It's been helpful mainly by emphasizing how important the environment is, something I intuitively knew beforehand but couldn't articulate as well.” When discussing whether the online courses impacted him in any way, Greg succinctly shares, "Thought process/ideas... creativity." Jeff elaborates, stating, “I have been more aware of the multiple variables when it comes to movement and skill acquisition. I shifted

my thought process to not be driven by pieces of a movement and more of keeping the movement paired together.” Likewise, Devin, who works in American football, said, “I think more about how my players interact with the environment.” Further, Jackson offers:

> It has given me a different view of the training process. It has helped me see that everyone has a different way of learning skills and to be open about different ways to help athletes find the best way they learn.

Additionally, in his comment below, Diego makes some humble statements and asks himself some honest questions:

> I am constantly second-guessing myself in a healthy way. Asking myself, "could I have approached this better?" I feel much more "free" as a coach. I am no longer hyper-focused on mechanics but am much more aware of the surroundings and the interactions between the athlete, their task, and the environment they are in. Instead of trying to fit athletes into molds, I can understand that each athlete is truly unique… Am I growing as a coach, and am I actually really trying to find what's best for my athlete?

Walker adds, “It introduced a way to think about how athletes move and develop skills. It opened me up to all the different ways to think about what we are doing with our practice time and what can be learned in a game/drill." Walter’s observations share similarities to two of the sections above (i.e., 4.2.5 and 5.1.1); he states, “It helped simplify and highlight different ways to utilize the ecological approach... My ability to inject variability into training has increased due to the course material.” From baseball, George comments:

> The Emergence online material has made us reconsider what "good practice" looks like. We reflect each day in what type of exposure our hitters got, and what opportunities for skill building they had. Were our challenges in practice relevant, or were they just hard for the sake of making things hard but not representative?

Bjorn, who works in basketball, expressed thoughts about how the online material has shaped his thinking, saying, "It has been helpful in understanding the theory behind it... It has helped me understand my practice design better and reflect after practices on why the activities worked or did not work and how I could

change them." Furthermore, the material inspired deeper thinking for Harry; he shares, "The material was thought-provoking and different from the mundane traditional frameworks for coaching." Declan's thinking was inspired as well; he adds, "I re-centered some of my thinking on the most important underpinning concepts of an Eco-D approach." Joey contributes a similar thought: "It has given me examples from a variety of sports on how to evaluate an environment and try to implement work that will prepare the athlete for the hectic environment of sport." Billy commented, "Looking at skill development through an ecological lens helped me see the sport and learners from an entirely different perspective."

From the comments above, it seems clear that the coaches were inspired to reflect on their practice design and investigate and appreciate the interactions between the task, the individual, and the environment (e.g., Chandler and Diego). Moreover, coaches ruminated about how they could modify existing activities to facilitate skilled movement behavior (e.g., Jeff), and coaches made changes to their practices by ensuring task variability (e.g., Walter). Not only are coaches making changes in their practices and analyzing movement and their involvement differently, but they also expressed that they are simply reflecting on the effectiveness of the practice activities (e.g., Bjorn). This is a critical acknowledgment because, from an ecological perspective, learning is considered adaptive as a distributed process across the coach-athlete system (Orth et al., 2019), where an effective coach, through constraint manipulation, can design or set up movement problems and subsequently manipulate constraints to use soliciting affordances (Withagen et al., 2012). Other coaches elucidated this as well, explicitly stating their changed perspectives on their role as coaches while illustrating what the changes signify in their professional practice. For example, Ross commented, "I used to be more coach-centered as well but have moved to

a much more athlete-centered model.” Likewise, Nathan said, “The greatest change has come in how I view my role as a coach. I've evolved from seeing myself as a disseminator of information to a guide.” Gordon stated, “I view my role as a coach as a transition from perceiving my role as a solution provider to perceiving my role as a problem designer." Liam added, “It's not 100% me anymore.” The comments above were also conveyed in Section 5.2.1 when coaches shared their thoughts on becoming problem setters or activity designers, where athletes could work through the problem-solving process.

The third helpful takeaway for the coaches was their increased ability to analyze movement from a different perspective—one that considers the individual-environment relationship, which is not surprising given the new considerations on how skill emerges discussed above. The ability to analyze movement differently was also interwoven into some of the previous comments from coaches (e.g., Oliver's comments in section 4.2.2 and Gordon’s in section 4.2.3). With the focus of analysis being on the individual (athlete)-environment relationship, coaches, such as Oliver, stated:

> This has also had a positive impact on when I analyse and watch games at the highest level in my sport. I now watch to find common problems players face and consider how I can design practices to help develop younger players' abilities to interact with these problems… When reflecting on practices, I look back more on how my players responded in their own way to the problems they faced in the training environment than on how well they did up against my own criteria for how to act efficiently in that moment.

It is important to highlight that watching games from an ecological perspective has inspired Oliver to contemplate how he could (or should) design problems that invite athletes (especially lesser-skilled individuals) to interact with situations similar to those faced in competition. He also shared how his changed perspective has impacted how he views the IMS organized by each player to solve the emerging movement problem (allowing for the expression of

individuality) rather than what he expected their movement to look like. This change in thinking emphasizes the value he perceived from the online educational material. The online courses also shaped Zafir's analysis process. He expressed, "I learned how to analyze videos—the relationship between the team." Dante noted similar strengths after engaging with the online courses, offering, "My strengths definitely reside in analyzing the performer-environment relationship while identifying all the potential variables that could be explored to allow athletes to increase their dexterity." A common perceived value, and central to each comment shared by the coaches, is the importance of expanding their analysis beyond what the individual is doing, instead investigating the interactions between individuals and how they behave in the competitive environment.

Finally, it is important to highlight a theme that has been mentioned several times already (e.g., see 5.1.1), suggesting that the online education material supported or enhanced the learning opportunities that coaches had already engaged with. Nolan states, "A lot of the time, EcoD terms are overlapping and confusing. It was by far the most digestible map I've found." Ross proclaims, "I have read many resources on this view and found it helpful in explaining sport/training." Similarly, Zafir offers, "After attending Emergence online learning, I am able to read more articles and attend more conferences regarding athletes' movements… By engaging the new studies and listening to podcasts and online resources, help me to [uh] understand that a new way is better to help the goalkeeper pick up information from a real player. So I start to use a real player to [um] in the practice, so the goalkeeper has more information to pick up and [body] orientation, body language." While Zafir's comments offer insights into his practical applications, more so, they confirm the online education material contributed to his learning in other areas, collectively deepening his

understanding of ecological dynamics. It is clear from the remarks of these three coaches and the others referenced above that the online courses from Emergence were delivered in a way that provided clarity, giving rise to coaches and practitioners engaging in other learning opportunities, such as articles and podcasts, each supporting each other, collectively deepening their understanding and ability to apply ecological ideas in practice.

5.4. Conclusion

Coaches and practitioners indicated that their confidence increased, therefore supporting them in successfully employing NLP ideas in their unique training environment. This finding is critical and adds to the literature that was outlined in Section 2.5.1, which is the paucity of research investigating the confidence level of coaches after interacting with online education material. Not only does my research contribute to knowledge and practice, but it specifically addresses the perceived confidence increase after interacting with ecologically underpinned material. Moreover, making pedagogical shifts, regardless of the country or region in which one practices, can be difficult. While loss of credibility or not knowing when to intervene are real concerns (Roberts, 2011), they were not expressed by the coaches and practitioners in this study. However, when analyzing the coaches' comments, it is clear that confidence reduced any feelings of uneasiness or apprehension during the implementation of the ideas in practice. Therefore, this finding indicates that online courses and interactions, which elucidate the key principles of ecological dynamics and NLP and demonstrate how they are applied in practice, can advance knowledge, increase confidence, and subsequently help coaches and practitioners 'bring the ideas to life' in their professional setting. The application of the ideas was of utmost importance, as was explicitly stated by several coaches above (e.g., see Finn's comments in

section 5.1.1). Seeing and hearing how other coaches set movement problems and purposefully manipulate constraints helped bridge the theory-practice gap and assisted coaches in applying the ideas in their unique learning environment.

The results reported within this chapter show that coaches and practitioners clearly perceived a change in their ability to design or set up ‘alive movement problems’ to assist athletes in becoming more adaptable. Moreover, in doing so, coaches expressed that athletes were moving more skillfully or attempting to solve movement problems differently. Additionally, patience in learning was perceived as a strength of several coaches (e.g., see Maverick, Jaylen, and Walker’s comments in section 5.3), which, as mentioned above, is critical as athletes progress at different timescales (Button et al., 2020; Chow et al., 2016; Gray 2021). Furthermore, reflecting on practice design, considering interacting constraints on behavior, and communication were acknowledged as helpful to their coaching after engaging in the online learning material, indicating they are continually looking to evolve their coaching. The ability to analyze movement from an ecological perspective (i.e., with a performer-environment scale of analysis; Davids et al., 2008) was also conveyed as a newfound or enhanced ability (see section 5.3) by the coaches and practitioners, which was an expected outcome from courses and interactions delivered about ecological dynamics and NLP, which adopt a performer-environment and problem-solution perspective. This change in coaching, stemming from a new viewpoint on investigating movement problem-solving, is a key finding, and it confirms that online learning options can assist coaches and practitioners in improving their craft. Overall, the coaching changes mentioned above, which were perceived as valuable additions, illustrate the advancement of practice. In the previous two chapters, coaching changes and the value that was perceived from the online

educational material were discussed. In the following chapter, the second theme will be addressed, which outlines the challenges and areas for improvement observed by coaches and practitioners when applying a contemporary approach to skill acquisition in their unique learning environments.

Chapter 6: Challenges Identified and Opportunities Illuminated to Improve Coaching Skills

6. Introduction

The findings reported above show clear evidence that the coaches and practitioners perceived a positive impact on their practice after interacting with the online educational material. Chapter 4 highlighted multiple changes coaches made to their practice, including embracing the notion of representative learning design (RLD), purposefully manipulating constraints, simplifying practice tasks to help athletes develop information-movement couplings, prioritizing movement variability, and guiding the athlete's search by educating their intentions and attention. In Chapter 5, coaches and practitioners acknowledged changes to their confidence, which assisted them in applying the theoretical ideas in their sessions. Moreover, coaches and practitioners expressed changed perspectives in their roles, where they view themselves as activity designers or problem setters, where the movement problems they designed assisted their athletes in becoming more adaptable. After taking the online courses from Emergence, the coaches and practitioners shared additional helpful takeaways that they perceived as strengths in their coaching (e.g., becoming more patient; see section 5.3).

In addition to the positive impact perceived by coaches and practitioners outlined above, a few areas of weakness and opportunities for improvement were also acknowledged, which will be addressed in this chapter. Before the conclusion of the chapter, in Section 6.1.2, additional thoughts and experiences after implementing a contemporary pedagogical approach in practice will be presented and discussed.

6.1. Theme #2: Challenges Identified and Opportunities Illuminated to Improve Coaching Skills

The second of the two main themes generated during the data analysis is titled *Challenges Identified and Opportunities Illuminated to Improve Coaching Skills*. While there was less data to support this theme generation, it was a shared experience of some who interacted with the online education material. A definition of the sub-theme is presented below, followed by findings that support its development.

Challenges Identified and Opportunities Illuminated to Improve Coaching Skills

While participants expressed a deeper understanding of ecological dynamics after interacting with the online material, several still struggled with "translating" the ideas to their specific practices. For others, as they are improving their ability to use ecological ideas in practice, there is a tendency to spend more time planning to create representative activities. Additional opportunities to improve practice design and coaching are obvious (e.g., improving in-session constraint manipulation, asking better questions to educate their intentions and attention, and working with larger groups). Moreover, using an ecological approach across the entirety of their practice and conveying the 'why' to parents and other coaches to create buy-in is a work in progress. Adopting a new framework to underpin practice design and coaching requires patience, consistent work, and the willingness to accept that learning is nonlinear.

6.1.1. Areas of Weakness and Room for Growth When Implementing a Contemporary Pedagogical Approach in Practice

Another focus of this study was investigating any weaknesses or challenges perceived by coaches and practitioners when applying contemporary

skill acquisition ideas in their professional practice. The areas identified are largely grouped into two categories: a) implementing the ideas in practice (e.g., manipulating constraints and working with larger groups), and b) understanding why change is needed or conveying the need to others after implementing the ideas in practice.

Three of the 47 coaches expressed struggles when applying contemporary ideas in larger group settings. Mickey stated, “I am still having some problems incorporating some of the concepts with a large group as resources are sometimes limited.” Likewise, Dante added, “Working with large groups.” Oliver had similar experiences, claiming:

> Whilst I feel I have improved in my own coaching skill set with individuals or small units, I believe I could improve more in coaching larger numbers, i.e., a whole team, when they are attacking or defending. Rather than do this through rules, cues, or "if this, then that" methods of coaching, I have tried to stick to very open "loosely assembled principles" that can help guide a team to develop functional synergies in how they attack, defend, and transition. Developing this over a longer period of time, i.e., throughout a pre-season, is something that I am trying to understand more and will use my own exploration opportunities as a coach of a team to learn this.

Embracing an individual-environment scale of analysis and attempting to purposefully manipulate constraints can certainly require more effort with larger groups. However, it has been suggested that having access to groups of greater size, especially those from the same team, can benefit coaches and athletes (Yearby et al., 2022). The larger numbers offer coaches opportunities to design practice tasks that are representative of competition and embrace problem-solving through repetition without repetition (Bernstein, 1967), where the ‘aliveness’ can be adjusted to meet individual learner needs (Myszka et al., 2023a; Yearby et al., 2024). Even though larger numbers presented challenges, as expressed above by Oliver, becoming adept at working with larger groups is a work in progress, and it is implied that value was perceived in doing so.

In addition to working with larger groups, other coaches found difficulty designing practices and applying a constraints-led approach (CLA), including the communication strategies employed. This is not a surprising revelation, knowing that an individual-environment scope of analysis requires coaches and practitioners to investigate the problem-solution dynamics to understand what athletes are doing well, which can be expanded, and what needs to be done to help them fill gaps in their skill set (Button et al., 2020; Myszka et al., 2023b). Moreover, the CLA is not a book of pre-planned drills that coaches should expect to use with everyone (Yearby et al., 2022). To use it successfully, it takes a coach who understands: a) skills are ever-changing; b) sport is a problem-solving activity; c) the notion of interacting constraints; d) affordances are individual and frame-dependent; e) their athletes' 'current' skill sets; and f) they will likely need to adapt their 'plan' during training to meet the learners where they are for further development (Araújo et al., 2006; Button et al., 2020; Fajen et al., 2009; Gray, 2021; Myszka et al., 2023b; Newell, 1986). In the following quotes, additional areas of weakness are identified, providing coaches with opportunities for growth to assist the athletes they partner with in training. Chandler describes the areas he has identified:

> The most difficult part is going from understanding the basics to actually building training prescriptions from scratch off of these concepts. It's a big leap, and you start second-guessing everything and if it's "right" or not. The more concrete examples a coach can get within his specific domain, the better. Then he will have something to latch onto as an example of what this looks like in his world… I'm not yet comfortable enough to be able to manipulate everything on the fly and have it all be 100% "ecological dynamics approved." I have to think through scenarios and really map out what makes sense ahead of time.

Similarly, Finn stated:

> The lack of [examples] or seeing how people were putting the ideas into practice. So like, maybe I understood the [theory] or I was like that sounds like a great idea, but then because you didn't see how other coaches were doing it or what it could look like, it was a bit of a challenge at first. I think

> now there's probably more out there, but maybe five or six years ago it wasn't as much, and there's kind of more practical papers and stuff out at the moment, whereas before it was mainly [theory] until quite recently.

Additionally, Felix added, “I've had to think a lot about how to ‘translate’ the concepts to my environment.” Joey offers his struggles applying the ideas, saying, “It can be hard to design the right situations or know if it is correct until it's been done.” The difficulties in structuring training sessions and designing individual practice tasks experienced by Chandler, Finn, Felix, and Joey are not unanticipated. When coaches decide to move away from the safe comfort zone of using instructions to prescribe what learners should do and activities that have a ‘one-size-fits-all’ solution and are typically drilled in unopposed environments to those of problem-solving, challenges are expected. Finn described the importance of seeing and reading about practical examples and how, until recently, there was not much available to guide his application. He also noted how there is more information available, and again, this points to the complementary nature of online courses, live interactions, and other learning opportunities. Lastly, much like working with larger groups, Joey’s comment suggests that with more practice, his ability to design practices underpinned by ecological dynamics will improve.

George describes his struggles with scaling the complexity of the tasks through manipulating constraints, mentioning:

> A weakness we have found is perhaps pushing athletes into challenges that are too difficult too quickly. We could probably wager greater buy-in from the athlete by ramping up a progression of skill building challenges vs. challenging them too hard right from the get go of practice.

In the comment above, George also outlines the value of appropriately challenging athletes and meeting them where they are to drive skill adaptability. This is an often-broached topic (Gray, 2022), so it is an important concern, especially when athletes interact with activities that are different from the

traditional norms. Liam expressed similar comments as others above (e.g., Chandler's):

> I think using the constraints and stuff, it's always gonna be a work in progress and I'm always challenging myself to kind of come up with something a bit different here that might, you know, improve the skill set of my athlete.

Anton perceived weaknesses in applying the ideas through the form of communication; he said, "Applying informational constraints and/or feedback are my weak points... It requires a lot of practise for a coach to give feedback without leading the player to one-size-fits-all solutions." In addition to recognizing challenges using the CLA, Liam also mentioned other opportunities for growth:

> I think coaching players in this approach because they've come from maybe a more traditional linear approach where it was very top-down and coaches giving them a lot of information, almost a playbook in their heads that they should be able to pull from whenever they want. I think that's been a big challenge for me in that, um, you know, kind of getting to know the athlete. Look, where have you come from? What kind of coaching have you experienced before? And, I suppose, softly introducing things that are gonna be a small bit different.

This key point by Liam cannot be overlooked and is similar to comments from coaches in Section 5.3. (e.g., George), especially knowing that using the CLA involves knowing those you work with, where learning can be viewed as shared across the coach-athlete system (Orth et al., 2019). Mickey shared additional observations—the following comment is interesting and likely something most coaches and practitioners have all experienced at some point in their careers, potentially numerous times. He said, "I think my knowledge has definitely increased, but becoming more aware of the ecological dynamics concepts has also shown me all the areas that I don't fully understand, and I now feel like I have even more to learn."

The lived experiences of those above illustrate growth and a level of understanding because specific areas were noted as weaknesses. With

knowledge of areas that need improvement (e.g., applying the CLA with large groups), coaches know where to invest more time to adapt their skills and better help the athletes in their professional practice. Also, it is valuable to mention that several coaches (e.g., Finn and George) imply a sense of growing confidence, suggesting that coaching “skills” are ever-evolving. Collectively, these comments do not convey messages of frustration but rather some clarity about what they currently do not understand well and the desire to learn more, implying that as coaches, like athletes, ‘we know as we go’ (Woods et al., 2020b).

6.1.2. Additional Thoughts and Experiences After Implementing a Contemporary Pedagogical Approach in Practice

In addition to the weaknesses (i.e., opportunities for improvement) addressed above, a small number of coaches (5 of 47) experienced difficulties adhering to a contemporary pedagogical approach or explaining to others (e.g., parents of athletes) why they approach their practice differently. Moreover, coaches called into question whether they even wanted to change their approach to coaching. Several coaches and their thoughts are highlighted below. Walter states:

> At times, it is still hard for me to remove myself from the traditional approach I grew up with. Many times, I fall back on what I am used to and do not always think of applying the ecological approach.

This comment suggests value in shifting their approach to coaching and outlines how change can be difficult, especially if it comes after many years in the field approaching skill development differently. One goal of the Emergence online education material, as is the case with most learning opportunities, is to challenge one to think critically, and this comment implies that while they are drifting back to what they have always done, there is value perceived in a contemporary approach. Chandler expressed similar difficulties, and his comment shows that

he is aware that he transitions back and forth between different approaches. He said:

> I can see times and places where what I do isn't necessarily Eco-D focused. I don't automatically change these things if an athlete is having success, but I'm aware of them now… There are definitely times in the year and specific athletes where it may be appropriate to be less representative. I'm not "all in" to the point where every single piece of every session has to follow EcoD perfectly. I'm becoming more aware of my training choices and beginning to incorporate these concepts progressively more where it makes sense to me.

Additionally, a few coaches experienced challenges explaining why they approach skill development differently. Maverick acknowledged:

> I am not sure if this is a "weakness" or should more properly be called a challenge, but creating parent buy-in remains my primary struggle in applying ecological dynamics. Parents are conditioned to sign their child up for a specific "sport"—often revolving around their own sporting interests.

Likewise, Ross stated:

> To the parents who watch my practices, it may look like all we do is play games and don't work on specific skills. I obviously know this is incorrect, but for those that are not trained in this approach, it can look like a hands-off approach. I know many of the coaches I work with feel like this approach eliminates the need for coaches.

Peter did not express difficulty explaining his why, but he did convey related experiences by sharing:

> The weakness is that it is hard to convey what you are doing with patients to other practitioners because you are going against the status quo. My practice was already different, as we don't do any passive treatments. Adopting the ecological dynamics approach has set me further apart (I don't necessarily view this as a weakness, but it does make it harder).

With a traditional approach being more common and something parents likely experienced themselves if they participated in sports, physical education, or other movement-related tasks, it is not surprising that they might struggle to 'buy-in' when seeing a coach approach their practice differently. Moreover, articulating their 'why' to parents who have questions might be challenging for coaches who are still becoming comfortable using the principles of NLP. That said, the

comments do not insinuate that value was not perceived from the online learning material. Ross does not explicitly state that he has had to explain to parents the theory that guides his practice, but his statement implies that he either has conveyed his why or has contemplated how he would respond. Furthermore, it should also be acknowledged that the later part of Ross' comment about other coaches perceiving a NLP approach as being 'hands-off' illustrates their misunderstandings. This is the case for several reasons, notably because employing a CLA requires coaches to be deeply embedded within the learning environment (Gray, 2021; Renshaw et al., 2019; Yearby et al., 2022, 2024).

Peter acknowledges that approaching his craft differently than his peers presents challenges, and it is implied that he has had conversations with them to outline his 'why,' which likely challenged their methods in the process. However, even though he stated that adopting an ecological approach sets him apart even more from his peers, he seems convicted in his approach that came from interacting with the Emergence online material, which he outlined as very impactful to his craft (e.g., see 4.2.1). In addition to difficulties adhering to a contemporary pedagogical approach and explaining to others why the approach is used, Ethan added his observations, claiming:

> The hardest thing has been working with others to break free of traditional practices, i.e., moving from drill-based practice to game-based practice. And at times, this has led to uncertainty in possibly dealing with questions as to why I would want to change.

Likewise, Mickey adds:

> I feel like my knowledge has definitely increased, but becoming more aware of the ecological dynamics concepts has also shown me all the areas that I don't fully understand, and I now feel like I have even more to learn.

Comparable to Ethan and Mickey's comments, Finn shared, "While the ideas are intuitive and stuff, the theory behind it can be quite inaccessible." Ethan's

statement seems to imply that he has spent time ruminating about whether he truly wants to proceed with making changes to his pedagogical approach, whereas Mickey and Finn seem to simply be acknowledging that there have been moments of frustration, maybe calling into question some of the decisions they have made. However, they seem more convicted about moving forward with an ecological approach, noting the value they perceived from the courses, as substantiated by their remarks above (e.g., Mickey in section 4.2.2 and Finn in section 5.1.1).

6.2. Conclusion

This chapter acknowledged the weaknesses and challenges (or maybe more appropriately called areas of opportunity) that coaches and practitioners identified after interacting with the online coach education material. The two main areas coaches perceived as challenging included implementing the ideas in practice, especially when working with larger groups, and conveying their approach to skill development to others. These findings, and in particular the struggle when working with larger groups, are not surprising. Change can be difficult, and when there are larger groups, which means more interacting parts, there is a certain level of apprehension or nervousness, especially given that the coaches were involved in online learning rather than seeing someone apply the ideas in person. Moreover, only seven of the 47 coaches expressed any difficulty when applying contemporary pedagogical ideas in practice (e.g., purposefully manipulating constraints), which does not represent the experiences of the entire group; however, it is important to acknowledge. Even though seven coaches conveyed some level of difficulty applying the ideas in practice, most of them implied or explicitly stated (e.g., Chandler, Finn, and Liam) that improvement is expected or that it is a work in progress. This is important because, like anything

new, becoming proficient at something requires time. Their comments indicate an opportunity to improve and show a willingness to advance their craft.

Along with the weaknesses, two coaches (i.e., Walter and Chandler in section 6.1.2) experienced difficulties adhering to key ideas of the contemporary pedagogical approach, where they felt themselves transitioning back and forth to the ‘psychological and emotional safety’ of a more traditional approach. Both coaches' comments indicate value in shifting their approach to coaching. Additionally, both of them, especially Chandler, seem comfortable with their growth as they embrace the ideas and attempt to implement them in their practice. In addition to some difficulties when applying the ideas in practice, three other coaches and practitioners shared difficulties conveying their ‘why’ to others. Their experiences are not surprising given that this contemporary approach to skill acquisition is (and looks) very different from traditional approaches (Gray, 2021). Moreover, going against the norm is never easy and can certainly be accompanied by perturbation and resistance from others. Maverick and Ross acknowledge the parents of the athletes they work with, while Ross and Peter both mention their coworkers. However, their comments mostly describe their perception of what others are likely thinking when viewing them working with athletes and patients using a contemporary approach. With time and as their confidence grows, as outlined by numerous coaches in Section 5.1.1, their ability to convey their 'why' is likely to improve, just like the athletes' skill, as described by the coaches in Section 5.2.2. In conclusion, the results show that, just like anything, there will be ebbs and flows when adopting new ideas or attempting to hone how they are applied in practice. The next chapter starts with a summary of the key findings, followed by several sections elucidating how the research advances theory and practice.

Chapter 7: Advancing Theory and Practice

7. Summary of the Key Findings

The overarching purpose of this study was to explore the impact perceived by coaches (e.g., sports coaches) and practitioners (e.g., physical therapists) after interacting with and applying contemporary skill acquisition ideas in their professional practice. Specifically, the aim was to understand the lived experiences of these professionals and the application of the ideas learned, investigating what they perceived as strengths in their practice while also learning about areas of weakness. Finally, I examined whether confidence played a role in their ability to set up representative learning environments, manipulate constraints during practice, guide athletes' search for more functional performance solutions, and more.

The results indicate a positive impact was perceived on the professional practice of the coaches and practitioners after interacting with the Emergence online education material. There are two principal categories in which the results are themed. First, numerous ecologically-minded changes, including nonlinear pedagogical ideas (NLP), were made to the professional practice of the coaches and practitioners, conveying the value they perceived from the online material. Accompanying the changes the coaches and practitioners made in their practices, there were noticeable changes observed in the athletes' movement behavior, where increased movement skills emerged (see section 5.2.2). Additionally, the level of engagement and enjoyment during sessions notably increased as a result of the changes to the training sessions (see section 4.2.7). Secondly, some challenges were identified, and opportunities were illuminated when the changes were made or as they attempted to approach their craft differently.

The changes made to the participants' practice began with reflecting on their role in the learning process. Additionally, they began using the athlete-environment relationship (and the emerging behavior) as their scale of analysis. For some, these were complete shifts in how they analyzed movement; for others, their experience with the online material confirmed how they were already analyzing movement. These changes led to notable changes to the design of practice tasks, where representative learning design (RLD) was embodied and athletes were embedded in slices of the sport that varied in complexity (Pinder et al., 2011; Yearby et al., 2022).

Another change made by the coaches was prioritizing the athletes' experiences, where they assisted in the design of representative practice tasks (known as representative co-design; Woods et al., 2021c) to appropriately challenge their 'grip' on the field of affordances (Bruineberg & Rietveld, 2014). During the unfolding interactions in practice, coaches reported they were more adept at manipulating constraints that challenged the athletes' skills to help them exploit affordances or destabilize nonfunctional movement solutions (Gray, 2021).

Furthermore, communication strategies changed, where coaches transitioned from teaching specific techniques to asking questions to educate athletes' search for information so they could organize an individual-specific movement solution based on their action capabilities. Building on the change above, coaches and practitioners reported the value they now perceive in movement variability, individuality, and ownership (see sections 4.2.5, 5.2.1, and 5.2.2). These ideas were reflected in the shift towards viewing sport movement as a problem-solving activity, where adaptability became the focus of training sessions. This perspective directly contrasts with previous thoughts and

approaches that prioritized the repeatability of techniques in decontextualized environments.

Moreover, increased confidence was routinely mentioned by coaches after interacting with the online courses, suggesting that the changes were made possible through the notion of a newfound ability or one that had been strengthened (see section 5.1.1). This means the clarity and structure served as a foundation from which coaches felt inspired and capable of designing representative learning environments where constraints could be purposefully manipulated and the athlete's search could be guided. Other helpful takeaways reported by coaches that impacted their professional practice included patience with skill adaptability and understanding more about how the unfolding interactions during practice inform their activity design. Furthermore, the results indicate that easy access to ecologically-based material delivered online via recorded courses and live interactions with coach educators means that practitioners and coaches do not have to take a university degree (which can be more expensive and time-consuming) to update or enhance their knowledge and understanding of ideas in coaching and applied sports science, which are ever-evolving. Lastly, the results illustrated that the online education material gave professionals the foundation to seek more knowledge and information, for example, to read books, journal articles, and attend conferences. Importantly, their learning experiences with the online professional development material highlighted that the two types of learning opportunities (i.e., nonformal and informal; see section 2.4 for more) complemented one another.

While changes were made in their professional practice and their confidence in their ability to do so increased, there were also perceived weaknesses in their craft, leading to opportunities for improvement. Although

most felt comfortable and found success implementing the ideas in practice, a few coaches reported difficulties they perceived, including working with larger groups, designing representative learning environments, manipulating constraints with purpose during training sessions, and giving feedback without leading the athletes to one-size-fits-all solutions. Other than the challenges observed in their practice, a couple of the movement professionals mentioned difficulty explaining their 'why' to others, including parents and colleagues. One coach even mentioned that at times, they question whether change is even needed.

7.1. Advancing Theory and Practice

In addition to the key results expanded on and analyzed in the previous chapters and summarized above, other significant findings will be discussed in the following sections, describing the extent to which additional areas of interest have been impacted; for example, those working with athletes of different skill levels (i.e., youth to professionals) and those with varying levels of experience (i.e., years working in their respective fields). Next, the benefit of online learning perceived by coaches and practitioners is explained, followed by a brief revisit of the principal points of positive impact after interacting with and applying contemporary skill acquisition ideas in their professional practice.

7.1.1. Positively Impacting Coaches and Practitioners with Sociocultural Differences

Coaches and practitioners who participated in the study were located across the world, representing 11 countries. Of the 47 participants involved in the study, 28 were from the United States of America, which represents a huge landmass and a very diverse population of people with sociocultural differences. Moreover, participants included seven socioculturally diverse countries

throughout Europe. Even though there were only three coaches from Canada, one from Saudi Arabia, and one from Australia who participated in the study, when coupled with those who live in the United States and European countries, the coverage across the globe is expansive. Furthermore, considering that 97.9% (see Figure 4.3) of coaches and practitioners expressed that their ability to use ecological ideas in their professional practice either increased (68.1%, 32 of 47 participants) or somewhat increased (29.8%, 14 of 47 participants), this tells a compelling story, demonstrating the positive impact on practice perceived by participants across socioculturally diverse areas of the globe.

This finding greatly contributes to the existing literature because it confirms that contemporary theories of skill acquisition delivered online can assist coaches interested in successfully applying the ideas in their practice who live in different parts of the world with diverse sociocultural backgrounds. To my knowledge, the only other study that investigated the experiences of coaches using a contemporary pedagogical approach in their practice was conducted by Stone et al. (2021). They interviewed 15 coaches across six countries and focused on why they switched from traditional to contemporary approaches in practice. The current thesis adds to this existing body of knowledge and suggests the value of extending these analyses to the investigation of the outcomes of online learning courses.

Other than the research by Stone and colleagues, other studies, as acknowledged in Section 2.5.1, have primarily focused on the perceived value of interacting with specific learning pathways (e.g., informal internet searching and nonformal courses targeting particular subgroups in the population) without mentioning the specific theory that supported the development of the content the participants interacted with to improve their practice. Conversely, my research

analyzed the experiences of coaches and practitioners after they interacted with online educational material underpinned by a contemporary approach to skill acquisition (section 2.2 provides detailed background on ecological dynamics). Therefore, learning more about the positive impact perceived by coaches and practitioners who span 11 socioculturally diverse countries and four continents, with a specific focus on their applied experiences, helps contribute to the existing literature by showing that online engagement with ecological ideas positively impacts the development of skills for both coaches and athletes.

7.1.2. Positively Impacting Multiple Professions and Coaches Working in Different Sports

Another significant finding is the positive impact perceived by those working in contrasting professions and within different sports, including both team and individual. For example, head coaches (e.g., Giovanni who works in basketball, see section 4.2.1.), position coaches (e.g., Diego who works in baseball, see section 4.2.2), strength and conditioning or athlete development coaches (e.g., Hayley, see section 4.2.5.), physical therapists (e.g., Peter, see section 4.2.1), and physical education teachers (e.g., Finn, see section 4.2.2), all described strengths perceived in their professional practices after applying ideas discussed in the Emergence educational material. Learning that individuals across different professions were positively impacted by the online material signifies the value of ecological dynamics and shows the extent to which the framework can serve as a foundation for understanding skill, performance, and development in a variety of settings. Furthermore, it is essential to note that a few coaches mentioned working in more than one line of work, further substantiating the applicability of ecological ideas across different fields and environments.

In addition to the positive impact perceived by those working in different professions, coaches working in more than ten sports perceived the online learning material as impactful to their professional work, demonstrating that an ecological dynamics framework and NLP principles (which are constructed and developed on the theory of ecological dynamics; Chow, 2021) can serve as a way of understanding the emergence of movement and provide coaches with tools to help athletes adapt their skills in sports. Regardless of the sport, coaches reported the greatest impact being their enhanced ability to design representative learning environments (see section 4.2.2), purposefully manipulate constraints (see section 4.2.3), and communicate more effectively (see section 4.2.6). These findings illustrate the theory-practice link and clearly demonstrate the positive impact the online education program had on their professional practice, where coaches 'brought the ideas to life' in their unique and varied learning environments, showing that online courses can keep coaches up to date with new ideas and approaches.

Section 2.5.1 acknowledges a gap in the literature, which describes the lack of robustness among the participants included in other studies. Most of the studies typically investigated coaches from a single sport (e.g., ten youth-level head soccer coaches in Koh et al., 2017), with a majority also including participants from the same countries (e.g., the USA's national swimming online program; Driska, 2018). Additionally, most of the coaches had similar levels of experience and qualifications. As stated, my critique is not about the focus of the studies; rather, it is to highlight the need for research in this area to include a more diverse participant group. Therefore, this section demonstrates a unique contribution to practice by illustrating that online education, underpinned by

ecological dynamics, positively impacts those working in different sports and contrasting professions.

7.1.3. Supporting Coaches with Varying Knowledge of Ecological Dynamics

One of the more informative findings from the research was hearing how the Emergence online educational material helped impact the craft of coaches with varying knowledge of ecological dynamics and the key principles of NLP. Several coaches, such as Giovanni in Section 4.2.1 and Desmond, Nathan, and Finn in Section 5.1.1, described a previous level of knowledge; however, they expressed how concise and easy to understand the online material was, outlining how it helped them connect the dots to apply the ideas in practice. In Section 5.1.1, Jesse even went as far as stating, “Man, I wish I had started with this. It would have saved me a lot of time.” Furthermore, even with a grasp on the underpinning concepts, Finn (see sections 5.1.1 and 6.1.1) delineated the importance of seeing how others apply the ideas in practice. His comments and the others mentioned above show that the impact was perceived even with a solid awareness of ecological dynamics.

The way the material was delivered online also supported coaches who may have been less familiar with ecological dynamics or needed more direction when applying a contemporary approach in their practice. For example, Goose and Oliver (see section 4.2.3) shared how they have more intention behind the constraints they manipulate. Other coaches, such as Mickey, shared, “I intuitively knew that trying to make drills as realistic as possible is the ideal, but the online courses helped to provide a framework to implement in order to achieve this goal” (for more, see section 4.2.2). Moreover, Zafir details how the material helped him design representative learning environments (see section 4.2.2), educate the

athlete's search more effectively (see 4.2.6), and increase his confidence in manipulating constraints (see 5.1.1). Felix and Carter's comments in Section 5.1.1., which are oriented around the online material providing clarity and offering a starting point for applying ecological ideas in practice, succinctly capture what many others felt after interacting with the material (e.g., see section 5.1.1). The findings show that the delivery of the ideas online positively impacted coaches and bridged the gap between theory and practice, regardless of how much was understood when they initially interacted with the Emergence educational material.

7.1.4. Supporting Coaches with Varied Experience

In addition to the online educational material supporting coaches with varying knowledge of ecological dynamics and NLP, the findings show the material was helpful for those who have spent different amounts of time coaching or practicing in their respective fields. Their experience ranged from less than two years to over 20 years (see Figure 7.1), with over half of the participants (i.e., 25) having six to 15 years of experience. Along with their varied experiences, it is important to highlight the diversity of sports and their perceived impact.

Figure 7.1.

The number of years the participants have been coaching or practicing.

For example, Steve works in mixed martial arts (MMA) and has been coaching for two to five years; Giovanni works in basketball and has been coaching for six to ten years; Liam works in tennis and has been coaching for 11 to 15 years; and Mickey works in Canadian football and has been coaching for over 20 years. Comments from these coaches delineate the impact the online material had on their professional practice (e.g., Steve in 4.2.7, Giovanni and Liam in 4.2.1, and Mickey in 4.2.2), ranging from supporting them in the design of representative learning environments to the increased ability to design sessions that have students more engaged while developing their skills. Therefore, after engaging with the Emergence online educational material, coaches and practitioners who are new to the profession (i.e., less than two years) and those with extended experience (i.e., over 20 years) were able to evolve their practice and further benefit those they work with. The impactfulness

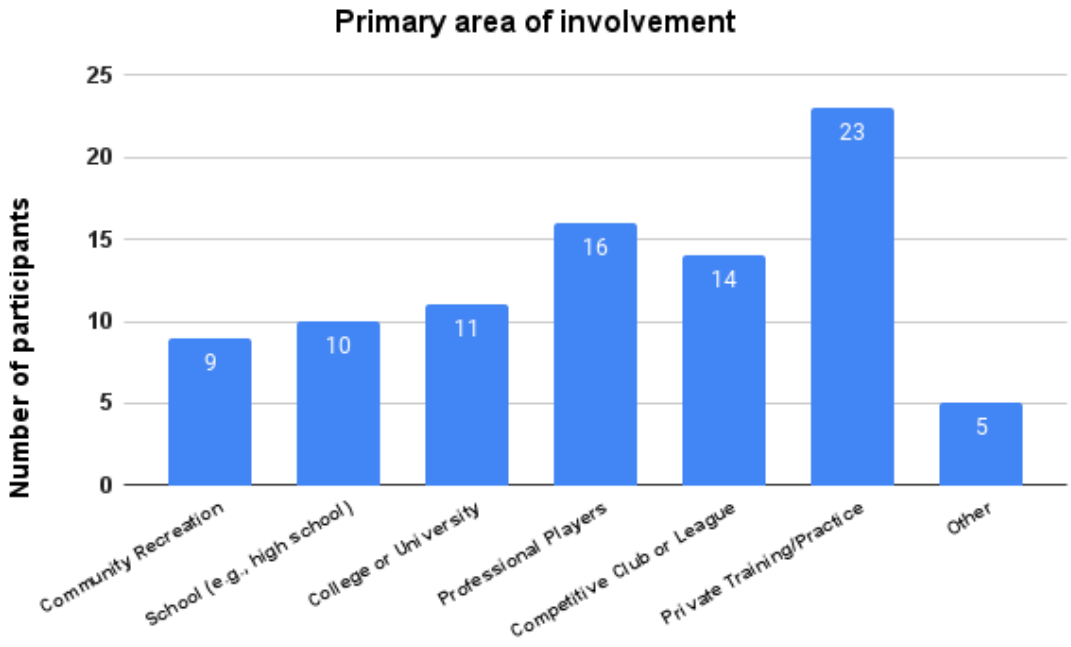
of these findings cannot be understated; the online material supported a wide range of professionals in making positive changes and improving their craft.

7.1.5. Supporting Youth to Professional Athletes: Increased Movement Problem-Solving

Another significant finding from the study was the ability to impact athletes with varying skill sets and at different stages of development. This is not surprising given the athlete-environment scale of analysis, which is central to ecological dynamics (Davids et al., 2008). By analyzing movement from this perspective, coaches can glean more about the strengths and weaknesses of those they work with to design learning environments that help athletes improve (Gray, 2021; Yearby et al., 2024). Section 5.2.2. offers observations from coaches and practitioners who experienced positive changes in their athletes' abilities to solve problems. Importantly, athletes ranging from youth to experienced professionals improved their skills. For example, Liam, who works with youth athletes in Ireland, and Gordon, who works with professional players in the United States, both expressed that the individuals they work with are solving problems in different ways and moving more skillfully. Figure 7.2. illustrates the diverse populations that coaches and practitioners of this study are working with during their professional practice. The diversity, along with the coaching changes participants made and their perceived impact (see sections 4.2.1. to 4.2.6.), demonstrate the utility of ecological ideas across populations. Moreover, Section 4.2.7. describes how athletes enjoyed practices more than they previously had and were more engaged throughout the sessions; this seemed to be the case regardless of ability level (e.g., Harry works with advanced athletes, and Maverick works with youth).

Figure 7.2.

The participants' primary area of involvement (i.e., the population they work with in their professional setting).



These findings further describe the positive impact on the coaches' and practitioners' unique and varied learning environments through their improved ability to apply an ecological dynamics framework and NLP principles in their practice. Furthermore, the findings support previous research, in which coaches acknowledged improved learning outcomes by using a contemporary approach to skill development (Stone et al., 2021). With an online focus, my research adds to the limited existing literature, such as the paper referenced above, advancing practice by investigating coaches' perceived impact after interacting with and applying contemporary ideas in their coaching.

7.1.6. Different Learning Opportunities and How They Complement One Another

Potentially the most informative finding was the complementary nature of the online educational material from Emergence (categorized as nonformal

learning, see section 2.4) and other learning opportunities such as research articles and books, which are categorized as informal learning (Nelson et al., 2006). Explicit statements (e.g., see Dante and Carter's in section 5.1.1) and latent thoughts (e.g., see Finn's in section 5.1.1) outline how the delivery of the Emergence educational material (see section 7.2 to see what makes the Emergence learning opportunities different) helped make the theory accessible to apply the ideas in practice. The different learning opportunities are considered complementary because one rarely (if ever) learns from a single source. Much like the mutuality between the athlete and environment (Renshaw et al., 2019; Yearby et al., 2022), I feel there is a relationship between different modes of learning, for example, nonformal courses provided by Emergence and formal learning opportunities offered by universities. While not a key research objective, these findings add to existing literature in two principal ways. First, the results confirm that it is helpful for learning opportunities to be guided, offering points of reflection throughout the journey to encourage coaches and practitioners to consider their unique situations for transfer to their professional settings. This more mentorship-oriented approach (Wood et al., 2022; Lascu et al., in press) is in stark contrast to knowledge 'delivered' to coaches in an excessively didactic way, which may disregard individual needs, something already noted as undesirable (Mesquita et al., 2014). Secondly, the results suggest that learning from multiple sources may be superior for advancing practice, especially with regard to the time demands on professional practitioners. Therefore, the results indicate that more than one mode of learning (e.g., university modules and bespoke, nonformal learning opportunities) should be included by educational providers to assist learners, in this case, coaches and practitioners, so they can more effectively help those they work with in their professional practice.

7.2. The Benefit of Learning Online: Key Messages for Coach Education - Accessibility, Pace of Learning, and the Value of Interacting with Others

This section entails relevant findings that are only distantly related to the two main themes and sub-themes. Even though a separate theme was not generated, the information is valuable in understanding more about the benefits of online learning, which is critical to the research question. It is important to note that the observations from the participants below often intertwine several important points they perceived when interacting with the online material (e.g., accessibility and pace of learning), indicating value was perceived on multiple levels. Moreover, the results indicate that the theory was made more accessible through the delivery of the material online, which included individual or group interactions (e.g., Movement Meet-Up calls offered to everyone and panel discussions at the Sport Movement Skill Conference).

Accessibility means ease of access at times convenient for the coaches at the location of their choice and other specific learning preferences (e.g., pausing and rewinding presentations), the ability to engage with professionals located all over the globe, and also suggests that *how* the material was delivered made the complex scientific information 'understandable' so the ideas could be applied in practice. For example, when asked why learning online interests them, Diego commented, "The ability to learn wherever I am located. I am not restricted by the constraints of where I live." Jaylen shared, "It is accessible whenever I want to learn." Walter expressed similar thoughts, saying, "The availability and convenience of learning whenever I have free time." Oliver attests:

> It provides me with more opportunities to participate in specific courses that wouldn't be available in the area I live in… Furthermore, learning online is a lot more accessible, especially during the busy season when there is limited free time to travel to face-to-face events due to training and matches.

Ethan mentioned the importance of online learning for him, emphasizing its accessibility, where he could work at his own pace to meet individual needs, saying, “Ease of access: I can work through the content at my own pace.” Moreover, Roy added, “The ability to do it at your own pace and access it on your own schedule.” Akin to those above, Felix contributes:

> The most interesting and exciting thing about learning online is the ability to learn at my own pace and on my own schedule. Traditional school frustrated me at times because I like to move fast and others did not, so I felt at times like I was being held back.

The last statement by Felix highlights a key benefit of learning online from bespoke education companies (i.e., nonformal education companies), where the pace and schedule can be regulated to meet individual needs. Walker offered similar observations, emphasizing the value of engagement preferences and accessibility, saying, “I can learn from anyone, anywhere in the world. I no longer have to wait or travel to them… You can rewatch a lesson.” Goose affirmed, “Online learning affords me the opportunity to learn at my own pace and at home… I also enjoy the ability to connect with material from authors who are located around the world and not near me.” Goose’s comment indicates interest in learning from both written scientific literature and online courses, suggesting their complementary nature, which highlights a point mentioned several times in previous sections (e.g., 5.1.1 and 5.3).

Bjorn shared his interest in learning online, stating, “This detailed information was not available at the university I attended.” From this comment, it can be deduced that, with ecological dynamics being a contemporary approach to skill acquisition, some (if not quite a few) universities likely omit the material from their curriculum. In Bjorn’s case, the Emergence course material offered learning opportunities he was keen to learn more about, and his comments show the impact he felt from the material. Moreover, the other comments express the

importance of accessing the material on their schedule, which demonstrates one reason why online learning has grown so rapidly over the past few decades (Allen & Seaman, 2005; Broadbent & Poon, 2015; Greenhow et al., 2022; see section 2.1). Ethan, Roy, Felix, and Goose all explicitly stated that learning at their own pace was valuable, further demonstrating accessibility and delineating that online education opportunities are a preferred form of learning. Furthermore, Walker's comment shows the value of accessibility, in this case being able to rewatch a presentation, which also shows how online learning opportunities meet the needs of learners.

Other coaches, such as Jerome and Liam, shared statements similar to those above, and they also outlined how online platforms promote engagement with others, which is of interest to them. Jerome said, "The ease of being able to access more information and collaborate with many more coaches in an interactive manner than previously available." Liam acknowledged something similar; he stated, "Sharing ideas and better collaboration among coaches." These comments support previous statements by coaches (Mesquita et al., 2014), indicating the immense value of interacting with others in coach education to advance understanding and practice.

The following remarks align with the comments in Section 5.1.1, which acknowledged the accessibility of the material in terms of it being digestible and easy to understand. Giovanni simply stated, "Concise and easy to understand." Mickey commented: "Accessibility is great, and the depth of information presented is also fantastic." These remarks by Giovanni and Mickey and those shared by other coaches and practitioners in Section 5.1.1 are important because they insinuate that the material is delivered in a way that makes the information understandable and applicable. Furthermore, the comments describe the value

perceived in how the Emergence online material is delivered, which is different from other forms of coach education that have been deemed to be too didactic and detached from the reality of coaching (Mesquita et al., 2014; see section 2.4).

In contrast, the pre-recorded options from Emergence (e.g., Underpinnings and the Practitioner's Bundle) are presentations that include checkpoints with numerous questions coaches and practitioners are encouraged to ask themselves to consider their training environments and reflect on what the ideas mean for them. Numerous verbal examples from various sports are offered during the courses to illustrate how the pedagogical principles could be used, and several videos are included to complement the examples and visually demonstrate how coaches and practitioners might apply the concepts in their learning environments. The examples suggest options, yet they are viewed simply as guides because every situation has differing constraints. Moreover, the material is delivered in a way that challenges the movement professionals to think critically, understanding that they may absorb what is useful or discard what is not, depending on their situation (Lee, 2011). The more interactive options (e.g., The Movement Academy; see section 3.1.1) are a deep-dive experience between students and the course directors at Emergence. The format is not fixed; rather, the soft assembly provides the course directors (guides) with the opportunity to meet the students where they are to assist with growth in the areas most needed. The interactive options are considered co-adaptive relationships.

Moreover, it is critical to emphasize that the Emergence course directors continually recommended that everyone research their own experience to glean the most useful information during the calls and ruminate about how ecological ideas might exist within their unique learning environments. Oftentimes, on both individual and group calls, the course directors will pick a sport that no one is

currently working with (e.g., handball), and collectively, the group will analyze the video, discussing ideas such as affordances and constraints shaping behavior. Choosing sports outside of the students' target sport typically took pressure off all involved because they were not expected to be experts. After the completion of the call, to increase the likelihood that coaches could more effectively analyze movement and purposefully manipulate constraints to drive skill adaptability, they were tasked with various homework assignments. For example, coaches might be asked to film two activities they designed for individuals in their unique learning environment and explain them and the unfolding interactions (including the guidance and feedback between the coach and athletes) to the course directors to solidify their ability to set up representative learning designs and manipulate constraints with purpose. Furthermore, coaches and practitioners are frequently given other homework assignments, such as reading online journal articles or listening to podcasts (e.g., The Perception & Action Podcast), which support them in learning about the key ideas and their application from other experts in the field who also adopt a guidance mindset, helping to nudge interested individuals to explore their own experiences. Importantly, these reading and listening assignments are given to support their practical experience applying ecological ideas in their professional setting.

This flexible, learner-centered delivery of education versus a didactic delivery of information could serve as an example for those at universities, national governing bodies, or those who own private education companies. Some are likely approaching educational development similarly, but the results from this study clearly show that learners are more interested in genuine guidance and engagement than being told exactly what to do in each situation they find themselves in. In conclusion, the findings support other research addressed in

Section 2.5.1 (e.g. Koh et al., 2017; Pope et al., 2015) that described the value coaches perceive, the time-saving features offered by online learning opportunities, and the ease and flexibility of accessibility. Importantly, it can be deduced that online learning opportunities—in this case, information about ecological dynamics—are desired and valued by movement professionals across the world, contributing to the paucity of literature in this area and helping advance knowledge and practice.

7.3. Principles with the Greatest Impact on Practice

The results demonstrate that coaches gleaned a lot from the online educational material from Emergence, finding NLP principles and other ideas espoused by ecological dynamics, such as 'alive' movement problem-solving, helpful to their coaching. This was illustrated by numerous changes to their professional practice (see section 4.2.1), along with additional comments throughout Chapter 4 expressing the positive impact they perceived. The key ideas that seemed to be the most influential in helping coaches and practitioners make changes to their professional practice were RLD, purposefully manipulating constraints, embracing movement variability, and guiding search through effective communication.

Increasing representativeness in practice means designing practice activities that look, feel, and behave like the sport, where the emerging affordances athletes perceive are similar to those they will interact with during competition (Button et al., 2020; Davids et al., 2008; Pinder et al., 2011). Coaches in this study (e.g., Mickey and Jeff; see section 4.2.2), as well as others highlighted in Section 4.2.2, expressed how they are now capable of designing activities that are 'more representative of situations the athletes will encounter in their sport setting' or that the tasks are as 'game-like' as possible. The changes

made begin to appreciate the importance of interactions, where the actions that emerge from an opponent or teammate will give rise to possibilities for performance behaviors for another (Gibson, 1979).

Through purposefully manipulating constraints (Gray, 2021; Yearby et al., 2022), coaches and practitioners perceived a positive impact on their practice. For example, Goose, Sean, Giovanni, and Oliver (see section 4.2.3) all explicitly mention how they are now capable of manipulating specific constraints for the athletes they work with in practice. These coaches illustrate how important it is that tasks are designed to destabilize existing movement solutions that lack functionality or to encourage the exploration of new movement solutions through amplifying information to invite affordances (Gray, 2021). This is critical to helping athletes expand their action capabilities, allowing for more skillful behavior in future interactions (Davids et al., 2008; Yearby et al., 2024). The coaches' responses about manipulating constraints in practice (see section 4.2.3) and their answers to the Likert scale questions on the survey, where 89.4% commented that their confidence when manipulating constraints in practice increased (51.1%, 24 of 47 participants) or somewhat increased (38.3%, 18 of 47 participants), clearly show their perceptions of improvement as coaches. Moreover, their satisfaction with the online educational material and the reported impact it had on their practice were also acknowledged.

After interacting with the online learning material, the notion of movement variability was embraced by coaches, who expressed the importance of their athletes exploring what is possible as they work through the process of solving changing movement problems. This finding is not surprising, and the coaches clearly understand that sports are inherently complex and offer highly variable movement problems for players to solve (Myszka et al., 2023b). Furthermore,

coaches throughout Section 4.2.5. offer their insights, which insinuate a changed perspective on the importance of repetitions, where they now value movement problem-solving and encourage players to explore various ways of self-organizing to find a functional fit to the problems they encounter in practice and competition (see section 2.2.5. for more on this pedagogical principle).

In addition to coaches expressing value in viewing movement as a problem-solving activity, the idea of being a guide where explicit statements or questions are used to educate the search process for athletes and patients was also perceived as valuable and a notable change to their professional practice (see section 4.2.6). This is important because coaches can illuminate areas where specifying information is available for pick up (e.g., the location of the ball during a tennis serve in relation to the server's body) or where 'soliciting' affordances may be available, which can assist athletes in organizing a solution unique to them and deepen their 'knowledge of' (Gibson, 1966; see section 2.2.2) the environment, leading to more adaptable movers.

The points above align with ideas in existing applied scientific literature (i.e., books and online journal articles), which encourage coaches to re-align their role towards being *designers* of practice tasks that are replete with opportunities for interactions (Button et al., 2020; Chow et al., 2016; Renshaw et al., 2019; Woods et al., 2020c; Yearby et al., 2024). In doing so, coaches can help provide a platform for better movement problem solvers and increased skill adaptability (Araújo & Davids, 2011). The coaches and practitioners in this study elucidated the positive impact they perceived from the online educational material by implementing changes in their professional practice. Even though those who engaged with the material have varied coaching experiences and live in different areas across the world, it seems evident that the information helped impact

coaches working in different sports, supported practitioners in different professions, and helped develop athletes ranging from youth to professionals. In summary, these findings suggest transferability to other coaching populations (Burke, 2017), which further indicates that online learning material underpinned by ecological dynamics can assist coaches and practitioners who are looking to help those they work with become more dexterous movers.

7.4. Conclusion

This chapter began with a summary of the key research findings, followed by a discussion about six significant takeaways of significance from the body of evidence, which included:

- The generally positive impact perceived by the sample of coaches located in diverse sociocultural environments.
- The positive impact perceived by participants in a diverse range of sports and professions.
- How the online educational material supported coaches with varying knowledge of ecological dynamics.
- How the educational material supported participants with varied experience in coaching.
- How online resources supported coaches in assisting those they work with to become better movement problem-solvers.
- The complementary nature of different learning opportunities (e.g., university courses, available reading material, and online courses).

Following the six major areas of impact that illustrate the advancement of theory and practice, the chapter outlined the benefits of online resources perceived by coaches and practitioners, namely accessibility in terms of learning preferences and ownership over the pace of learning. Concluding the chapter, the principles

with the most effective impact on the professional practice of coaches and practitioners were highlighted, namely the increased ability to design representative practices and purposefully manipulate constraints to guide skill adaptability. The next chapter outlines the major research implications and discusses possible directions for future research.

Chapter 8: Conclusion

8. Introduction

The main findings are evident and show that after engaging with the Emergence online educational resources, coaches and practitioners perceived that their professional practice had significantly improved, athletes moved more creatively and skillfully, and coaches and athletes enjoyed the training more than they had with alternative approaches. The results were highlighted by numerous coaching changes (see Chapter 4), an increased or newfound confidence when applying the ideas in practice (see Chapter 5), increased patience as athletes were learning to problem-solve, and reflecting more deeply about their professional practice. This reflection included reconceptualizing their role as a coach, reflecting on their own long-term development as practitioners, considering how skills emerge, designing representative practice activities, and considering the power of the individual-environment relationship and the interacting constraints that shape behavior.

8.1. Research Implications

The key findings from my research are significant, with a unifying characteristic being that the online material, underpinned by ecological dynamics, can assist coaches and practitioners in making changes in their professional setting—meaning, their ability to apply the ideas in practice was facilitated by the material they interacted with online. For some coaches, this enhanced understanding supported the application of ecological ideas in their practices (e.g., Oliver in section 4.2.3 and Goose in section 5.1.1), or it provided clarity and gave structure to how they could attempt to actualize the ideas in practice (e.g., Anton and Sean in section 5.1.1).

It is critical to mention that the online resources delivered by Emergence provided copious practical examples through video demonstrations with

information illustrating the benefits for numerous sports and other professions (e.g., physical education teachers). This suggests that videos (or in-person demos combined with online teaching) must accompany theoretical discussions, lectures, and assigned reading in order to provide a holistic experience to adequately support and bring meaning to contemporary ideas. Therefore, an applied delivery is especially important for universities to consider when hiring the right individuals to teach courses where the goal is for students to use theoretical ideas in their professional practice.

Moreover, the findings advance knowledge and practice in five specific areas. The first contribution is understanding the specific strengths and limitations coaches and practitioners perceived when 'applying' what they learned from the online resources—in this case, applying contemporary skill acquisition ideas in practice. Therefore, with an understanding of the applied experiences and positive impact perceived by the 47 participants from socioculturally diverse areas (97.9% reported that their ability to use the ideas in practice increased or somewhat increased; see Figure 4.3), this research advocates that other coaches and practitioners could benefit from adopting and implementing an ecological approach in their coaching.

Secondly, there is a paucity of research investigating the confidence level of coaches after interacting with online education material—specifically, education underpinned by ecological dynamics. My research confirms that coaches perceived positive changes in their confidence, assisting them in actualizing the ideas in their unique settings while creating an environment for skill adaptability (see sections 5.2.1 and 5.2.2). This finding is critical and further supports interested professionals who might be hesitant to engage with ecological ideas online that could support making changes in how they analyze

movement, design practices, communicate with athletes, and coach them to become more skilled movers.

Prior to this study, there was a dearth of research about whether contemporary approaches to skill acquisition delivered online could assist coaches living in different countries where unique sociocultural differences exist. The results of this study confirm the third significant contribution, which is the positive impact perceived by coaches, ranging from the United States to Australia (see section 7.1.1), who employed an ecological approach in their practice, supporting them in developing more adaptable athletes. Therefore, this evidence supports universities that are interested in creating online motor learning and coaching courses to positively impact students. Stakeholders can be confident that students will find value in self-paced online learning.

The fourth gap in existing research is a lack of diversity among the participants included in the studies. The diversity of professionals in my study (see sections 7.1.1 through 7.1.5) illustrates the positive impact the online educational material had on coaches and practitioners working in different sports, professions, cultures, those with a varied understanding of ecological dynamics, and those with different experience levels. Moreover, the online courses assisted coaches in helping develop athletes ranging from youth to professionals. The increased ability to *apply* the ideas during practice with elevated confidence while benefiting those they work with across the diverse participant group cannot be understated. Therefore, with 89.4% of coaches (see Figure 4.4) reporting that their confidence in manipulating constraints during practice increased (51.1%, 24 of 47 participants) or somewhat increased (38.3%, 18 of 47 participants), and 85.1% (see Figure 4.5) reporting that their confidence increased (61.7%, 29 of 47 participants) or somewhat increased (23.4%, 11 of 47 participants) in their

ability to design representative learning environments, online resources about skill acquisition underpinned by ecological dynamics and NLP can be confidently created by interested parties, such as universities and national governing bodies (NGB) aiming to advance applied knowledge.

Finally, my research clearly shows that learning about ecological dynamics and NLP through online education delivered via pre-recorded courses and live interactions on Zoom, combined with other modes of learning (e.g., university classes, books, and conferences), complemented one another. This means that the combination of experiences helped deepen the coaches' and practitioners' understanding and provided them with the needed support to apply the ideas in practice. Therefore, those in charge of designing course curricula must strongly consider the different modes of learning that are included to adequately meet individual needs (see section 7.1.6 for more). The applied knowledge reported by the coaches and practitioners in this study who interacted with the Emergence online coaching material, where coaches are guided to learn from many different sources, is in direct contrast to other experiences in more formal coach education frameworks, where expert coaches have voiced dissatisfaction. In Portugal, for example, professionals reported that the coaching educational framework “remains extremely didactic and classroom-orientated, resorting mainly to formal and explicit teaching techniques and where individual needs are disregarded” (Mesquita et al., 2014, p. 132). The authors of the paper went on to say, “This criticism focused on the promotion of subdividing coach learning into components, (turning it into a fragmented and de-contextualized process) and, consequently, incapacitating beginner coaches to transform theoretical knowledge into craft knowledge” (Mesquita et al., 2014, pp. 132–133). In addition to considering the different modes of learning, these comments imply that a

guided approach with an applied focus, such as Emergence online coach education, is superior and should be adopted by universities, NGBs, and others. Moreover, providing numerous pathways—in this case, different ways of interacting with the Emergence material (see sections 3.1.1, 7.2, or visit Emergentmvmt.com and click “View our courses” for all learning opportunity descriptions)—can assist by offering an entry point to using the ideas that meet the learner where they are. By doing so, there is a better link between theory and practice, making the ideas actionable in their unique learning environment.

In addition to the five points of impact addressed above, the generally positive evidence from this study shows that coaches and practitioners find value in learning opportunities underpinned by an ecological perspective that does not follow a predetermined path, which is often the case in highly structured formal coach education programs (Wood et al., 2022). Moreover, as mentioned in previous sections (e.g., see 4.2.6 and 5.1), an ecological approach is just as important for coach education as they are for coaching. Evidence from this study, which focused on the impact perceived by participants who interacted with Emergence online learning opportunities, which are underpinned by ecological and NLP principles, suggests that coach development adopts an ecological perspective to coach learning in much the same way as applied to the learning process in athletes and teams (Wood et al., 2022). Future research in this area is needed, but it seems logical to use ecological principles in coach development, especially since the same principles have assisted coaches in helping athletes move more skillfully.

Potentially the most meaningful finding that contributes to the existing research is how the results inform those creating educational content, such as universities and NGB. The supporting reasons (e.g., the perceived value of online

education from participants in different countries where unique sociocultural differences exist) were elaborated on in the paragraphs above and in previous sections (e.g., 7.1.6 and 7.2). Furthermore, the results illustrate that ecological dynamics and NLP provide an effective framework for coaches and practitioners to support those they work with in becoming more skilled (i.e., better movement problem solvers). The results show this is the case regardless of the movement professionals' background in ecological dynamics, what sport they work with, or what level of athlete they partner with in training. As mentioned earlier, this finding supports other literature by Stone et al. (2021), who had similar findings, although their focus was not after the coaches had engaged in online training.

8.1.1. Recommendations for Future Research

To further investigate the impact the online education material had on the coaches and practitioners and examine the application of the ideas in their professional practice, it would have been ideal to observe each individual in their professional setting (in person) to see their application of theoretical concepts. Unfortunately, since this was an unfunded project and was impacted by the pandemic, it was not feasible to visit numerous individuals across multiple countries. Future research could use a much smaller sample size—potentially less than five—with a focus on an area like Europe, where countries are clustered together, each with their own sociocultural differences that influence the way a sport is played and how it is coached, undoubtedly shaping the interactions between coaches and athletes—e.g., England's love of soccer and the electric stadium atmospheres (Amiri, 2023) or Spanish basketball with an emphasis on developing players with 'game knowledge' (Binner, 2023).

If one participant from five different countries, all working with different sports, was investigated (e.g., American football in the United States, football in

the UK, rugby in Ireland, basketball in Spain, and hockey in Finland), researchers might be able to glean more from their observations, further understanding the impact while still capturing diversity between participants (Ravn, 2017). This would especially be the case if the research were conducted by someone deeply familiar with ecological dynamics and NLP principles to see if the ideas were clearly understood and faithfully applied, assisting the researcher in observing the theory-practice link and better understanding the perceived strengths and limitations of applying the ideas.

Conversely, it might be advantageous to have hundreds to thousands of different participants (much larger than the present study) working across numerous sports with varied lengths of time in the field to see if the same results were found. In the present study, participation was voluntary, which led to 47 participants electing to participate—while not a huge number (just over 23% of the total invited), it still captured a diverse group (eleven countries were represented), and participants provided detailed feedback from their experiences. Furthermore, a potential project could include participants agreeing to record (both video and sound) some of their practice, which, combined with their responses on a survey and/or during an interview, would help the researcher learn more about the impact they perceived from the online education material (Day, 2017). In this way, their behaviors would be visible, further supporting their perceptions.

Additionally, "documents of life," which are resources that provide accounts of individual experiences (e.g., diaries) (Day, 2017), could be used in future research to assist in learning more about the participants' perceived impact from the educational material after applying the ideas in their professional setting—especially if the documented observations led to questions that

researchers could explore in subsequent interviews (Thorpe & Olive, 2017). Researchers could request that each participant document their lived experiences during and following each practice session on their phone or in a notebook, for example, which might aid in detailing day-to-day interactions so valuable information is not missed. Further, Sparkes and Smith (2014) suggested that web-based resources such as X (formerly Twitter) could offer additional insight and could also be used to enhance understanding of the collected data. In conclusion, there are numerous directions in which future research can (and should) go; using any combination of the above could allow researchers to weave a web of connections, constructing a more holistic perspective of the participant and the phenomenon in question (Day, 2017). Doing so will add to existing literature and improve the likelihood that educational providers meet coaches and practitioners where they are to advance their applied knowledge.

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Appendices

Appendix 3.1. Survey invitation email

Greetings,
I am reaching out in the hopes that you might be interested in participating in my doctoral research.

The purpose of my research is to investigate the perceived impact on the professional work of sports coaches and practitioners after completing online learning material (through Emergence) underpinned by ecological dynamics.

This survey is entirely voluntary, although I truly hope you consider assisting me in my research because your experiences and views are important.

The first stage of data collection is a survey, and the second stage is a semi-structured interview. You are not required to be involved in both phases, but after completing the survey, you may be selected and asked to participate in an interview.Along with your experience coaching after engaging with the Emergence education material, information about your gender, age, ethnicity, location, coaching position, and background may be collected.

All the data that is disclosed will be private and confidential. The data will be kept password-protected and only accessible to the research team. Any raw, non-anonymized data will be deleted as soon as the project ends. Anonymized data may be retained for future research purposes.

There are both open and closed questions, and it will likely take between 25 and 45 minutes, depending on the details you provide during the open-ended questions. If you wish to assist me in my doctoral research, please find the link to the survey below. The survey link will remain open until the end of the day on Sunday, December 11th.

There is a short glossary of terms for use during the survey. You can take a picture of it, so you can access it if you need it.

Many thanks, Tyler Yearby, M.Ed.

Appendix 3.2. Survey questions (Note: the first seven questions are the Informed Consent Form, which you will see in Appendix 3.6.)

1. Do you understand the area of research you are answering survey questions about?
2. Do you understand the global research objective?
3. Do you understand that I have asked you to participate in a research study by answering survey questions?
4. Have you read the information sheet and privacy policy?
5. Do you understand that you are free to contact me to ask questions about this study?
6. Do you understand that you are free to refuse participation or withdraw from the study at any time, without consequence, and that your information will be withdrawn at your request?
7. Do you understand that we will keep your data confidential?
8. Are you happy to continue?
9. What is your gender?
10. What is your age?

    18–30 years old, 31–45 years old, 46+, prefer not to say
11. Please specify your ethnicity.

    Caucasian, African-American, Latino, Hispanic, Asian, Native American, Native Hawaiian or Pacific Islander, Two or More, Other/Unknown, prefer not to answer
12. What is the highest education you have been awarded?

    High school, University/College, Master's, or Doctorate
13. In which country do you work?
14. What level are you currently working with as a coach or practitioner?

    Community Recreation, School (e.g., high school), College or University, Professional Players, Competitive Club or League, Private Training/Practice, Other

    a. If you selected "Other," please explain.
15. How much experience do you have as a coach or practitioner?

    I have never coached or practiced, Less than one year, Less than two years, 2–5 years, 6–10 years, 11–15 years, 16–20 years, or Over 20 years

16. What is the predominant age range of the players/clients working with you?

    Under 18, 18–24, 25–34, 35–44, 45–54, 55–64, 65 and older

Open-ended questions

17. What interests you about learning online?
18. What changes (if any) have you noticed in your coaching as a result of interacting with and then applying the concepts covered in the Emergence online learning material?
19. What strengths (if any) have you found in your craft after interacting with and applying ecological ideas in practice?
20. What interests you in learning more about a contemporary approach to skill acquisition?
21. How has the Emergence online learning material been helpful or unhelpful to your coaching?
22. Do you have any suggestions for improvements, refinements, or modifications to the Emergence online learning material?
23. What weaknesses (if any) have you found in your craft after interacting with and applying ecological ideas in practice?
24. How has the Emergence online learning material shaped your practical applications of ideas and reflections on practice?
25. Do you have any questions about this or future (more advanced) learning material in this area?

Likert scale questions

26. Has your understanding of ecological dynamics increased or decreased after completing the Emergence online learning material?

    Increased, Somewhat increased, No change, Somewhat decreased, Decrease

    a. Can you provide some reasoning for your selected answer?

27. Has your ability to use ecological ideas in practice increased or decreased after engaging with the Emergence online learning material?

    Increased, Somewhat increased, No change, Somewhat decreased, Decrease

    a. Can you provide some reasoning for your selected answer?

28. After interacting with the Emergence online learning material, has your confidence level increased or decreased when manipulating constraints in practice?

    Increased, Somewhat increased, No change, Somewhat decreased, Decrease

    a. Can you provide some reasoning for your selected answer?

29. Has your confidence level increased or decreased in your ability to design representative training environments after interacting with the Emergence online learning material?

    Increased, Somewhat increased, No change, Somewhat decreased, Decreased

    a. Can you provide some reasoning for your selected answer?

30. Should coaches understand the information players interact with during the game to adequately design practice activities?

    Strongly disagree, Disagree, Somewhat agree, Agree, or Strongly agree

31. Should players spend more time in representative training environments?

    Strongly disagree, Disagree, Somewhat agree, Agree, or Strongly agree

32. Should task constraints be manipulated (i.e., changed, altered) from repetition to repetition?

    Strongly disagree, Disagree, Somewhat agree, Agree, or Strongly agree

33. Should players face more opposed repetitions in practice?

    Strongly disagree, Disagree, Somewhat agree, Agree, or Strongly agree

34. Should players 'own' their decision-making; that is, should they be free to engage in practice activities in which they move based on their action capabilities rather than being told to behave in accordance with the coach's way of being and doing?

    Strongly disagree, Disagree, Somewhat agree, Agree, or Strongly agree

35. Should players spend less time in representative training environments?

    Strongly disagree, Disagree, Somewhat agree, Agree, or Strongly agree

36. Should task constraints stay the same from repetition to repetition?

    Strongly disagree, Disagree, Somewhat agree, Agree, or Strongly agree

37. Should players face less opposed repetitions in practice?

    Strongly disagree, Disagree, Somewhat agree, Agree, or Strongly agree

38. Are you more confident in analyzing movement in context now that you've interacted with the Emergence online learning material?

    Strongly disagree, Disagree, Somewhat agree, Agree, or Strongly agree

Appendix 3.3. Initial code and theme development examples from the survey data analysis

Early coding iterations

Code: By understanding more about the performer-environment relationship and constraints that shape behavior, my session design (and constraint manipulation) has improved to meet individual learner needs

Practice session design, theoretical foundation for methods. 9588-18

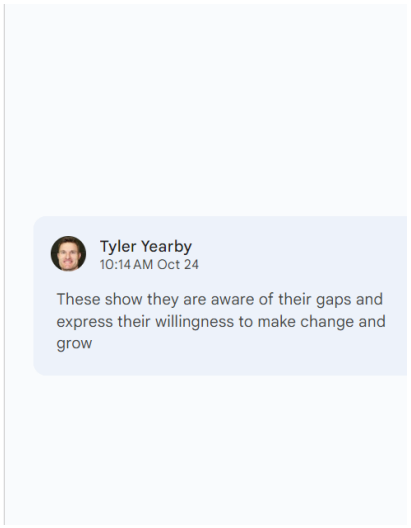
Better designing of tasks. 3755-18

It helped refine my skills. 7032-18

I am constantly second-guessing myself in a healthy way. Asking myself, "could I have approached this better?" I feel much more "free" as a coach. I am no longer hyper-focused on mechanics but am much more aware of the surroundings and the interactions between the athlete, their task, and the environment they are in. Instead of trying to fit athletes into molds, I can understand that each athlete is truly unique. 9673-18

I have been more aware of the multiple variables when it comes to movement and skill acquisition. I shifted my thought process to not be driven by pieces of a movement and more of keeping the movement paired together. 3521-18

I have began to view everything through the lens of constraints. Working across a variety of sports, I am curious in the similarities and differences in behaviour across sports - why do athletes move differently in AFL compared to Rugby, for example. Viewing sports as a set of constraints acting on a player or group of players has really enhanced my coaching eye. 5828-18



I also consider the individual athlete in a much different light—form of life, etc. 2419-24

This has changed my perspective on coaching tremendously. I now zoom out and look at all the factors to see what is influencing a movement. Then that helps me guide the athlete to come up with their own solution vs me providing the solution for the athlete and enabling their ability to problem solve. 3521-24

I no longer consider it a "good" practice only if it is clean-looking. I am far more comfortable with a messy practice being productive and useful than I used to be. 5422-24

It has given me additional knowledge and methods to expand the way the athletes I work with train. 3271-24

Is there a constraint that will teach it instead of me telling? 2607-24

Online material has given me confidence in the framework and a starting point to try 9602-24

It has helped me understand my practice design better and reflect after practices on why the activities worked or did not work and how I could change them 2496-24

Through opening my eyes to a different and more creative way of coaching that engages more people to learn 9034-24

Emergence and "Underpinnings" specifically have helped me understand ecological dynamics principles to a greater degree, which has allowed me to apply these concepts more effectively. For example, constraint manipulation and representative learning design 8499-24

Code: Movement authenticity, exploration, variability, and problem-solving are prioritized

Exercise technique has also become more flexible. Exploration and movement variability is seen as an asset. Problem solving is an absolute necessity. 5422-18

I am fine with them finding different solutions then what I thought was the correct way. 2607-18

We don't view coaching as a means of "prescribing an answer" but rather designing a practice that is going to promote relevant problem solving to build relevant skills. 3701-18

I have seen improved outcomes in my patients by not being as prescriptive and embracing variability. It gives me a framework to reframe what traditional physical therapy would call an impairment, to a movement problem to solve. 8356-18

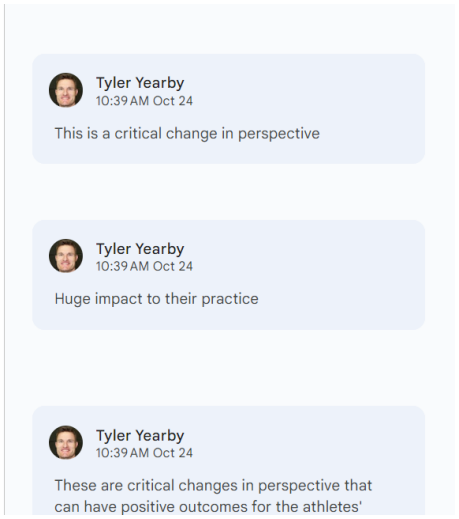
I also find myself trying to craft learning environments for my players where they are viewed as Problem-Solvers - where they can explore various solutions. 9478-18

The athletes I work with are better problem solvers. 0609-18

Another thing I am more aware of is that each athlete is completely physically different and that means they need to find solutions that work for them. 2607-18

It also provides an exploration of a problem rather than providing a "fix". 8356-18

Understanding that movements don't need to be "fixed" unless it is most likely a cause of an



Code: Finding a functional fit in representative environments is more important than isolated technique drills

I spend less time now focusing on what it looks like technically and more on how the players perform in different game settings. 6960-18

Having more of a focus on creating athletes who are problem solvers rather than ones who perform movements or drills with "perfect technique". 0162-18

How I view the role of the athlete: a transition from learning an ideal technique through rote repetition to wayfinding/problem-solving - learning to adapt movements as solutions to changing problems through the refinement of perception and action capabilities. 7851-18

I do not get as upset when they do something "incorrect" because I am seeing that there are a broader range of solutions. 2607-19

Understanding what's actually important in regards to sport and not just looking technically proficient. 6960-19

Tyler Yearby
10:41AM Oct 24

A change in perspective that now offers a platform for creativity and adaptability

Code: Learning about ecological dynamics has opened up new opportunities

The number one strength I have recognized thus far resides in my own authenticity as a learner and human being. I believe my candid and transparent nature, underpinned by a belief in growth & development. 9478-19

I really liked when I was engaging with the team members and having discussions. 4284-21

Yes, it has, as have my interactions with the Emergence team. 5749-21

It has made me rethink how I interact with patients, from the language used and directions given to the design of a treatment session. 8356-24

My increased understanding of ecological dynamics "has come from my own 1-2-1 calls with Tyler and Shawn and the reading material I was given for homework. The course inspired me to read more material (books, articles, etc.) around ecological dynamics, increasing my understanding of the topic." 2672 (q26)

After attending Emergence online learning, I am able to read more articles and attend more conferences regarding athletes' movements. 0522 (q26)

Tyler Yearby
10:45 AM Oct 24

An increased understanding supported their ability to make changes in practice

Tyler Yearby
10:45 AM Oct 24

The online material was delivered in a way that helped to elucidate how and why movement emerges, supporting them in taking the steps necessary to make changes and continue growing as a coach

Code: Communication is easier and more concise with players and coaches

More aware of my verbiage and the way I present information to players. 0385-18

This also links into my own communication with them when I might use verbal instruction to direct attention or intentions. 2672-18

Being able to guide the attention of the athlete and influence their intentions. Asking the athlete deeper questions instead of just giving them the perfect answer. 9673-19

The ability to ask better questions and help guide athletes to explore and take into account feedback. 8610-19

We require our newly hired full-time instructors to complete the Emergence Underpinnings course as part of their orientation and onboarding process. It allows us to start out speaking the same language. 8128-18

I'm more concise in my communication with the coaching staff about the EcoD ideas. 3755-19

It has afforded me tremendous opportunities to effectively communicate with both players and coaches. It has allowed me to recruit coaches and players as agents in their own skill development journey. 9478-19

Tyler Yearby
10:18 AM Oct 24

After engaging with the Emergence online education material, they are able to guide their athletes (and coaches) differently, and it seems they understand the importance of authentically connecting with the world around them

Code: Practice design and coaching now have a “why,” which aids in attempting to achieve the objective

Better understanding of applying the theory. 1697-18

I feel much more confident now, because I have a clear rationale for why, what, and how we do it. 4755-19

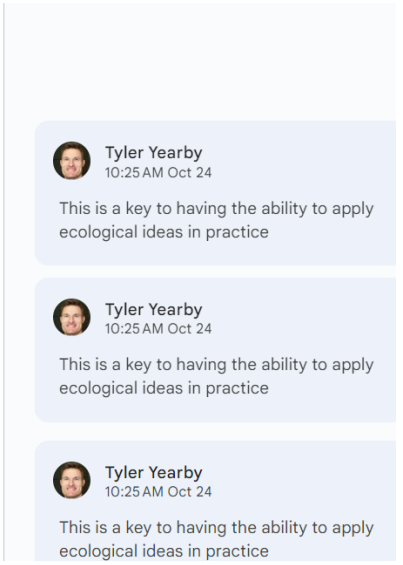
It has removed the guilt of moving away from the mechanical constructionist training ideas. 2143-19

I'm much more confident about my plan for helping athletes transfer training to game scenarios. It's not perfect, but there's much more thought process behind the transfer piece now. 6283-19

Looking at skill development through an ecological lens helped me see the sport and learners from an entirely different perspective. I feel I learn just as much as they are by observing emergent behaviors, strategies, and tactics. The failures and successes that I didn't plan for or expect are really informative. 5749-19

It made me more confident on that my ideas how take theory into practise / It increased my confidence in my ideas for putting theory into practice. 4755-21

The learning material helped me deepen my understanding and lend some structure to some ideas that have bounced around in my head. 5422-21



Code: A helpful perspective on coaching and skill development

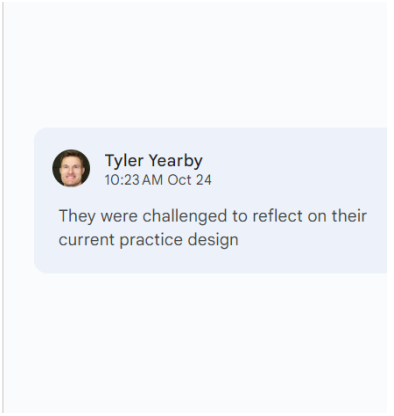
Just enjoyable to see it used with a movement focus versus a tactical focus; it was a little different than my typical online course. 2143-21

For me, it helps me understand a coaching approach that is different from the traditional method I have witnessed. 2171-21

The material was thought-provoking and different from the mundane traditional frameworks for coaching. 9034-21

It has given me a different view of the training process. It has helped me see that everyone has a different way of learning skills and to be open about different ways to help athletes find the best way they learn. 0609-21

It was really helpful. Now I am able to see things from a different angle and with a new perspective. 0522-21



Code: Collaboration "opens up" opportunities; dialogue with performers is important

My coaching is much more of a two-way conversation now. I work with the athlete to forge a path forward. 5422-18

Better communication. 3755-18

Being more in tune with athletes. 3996-18

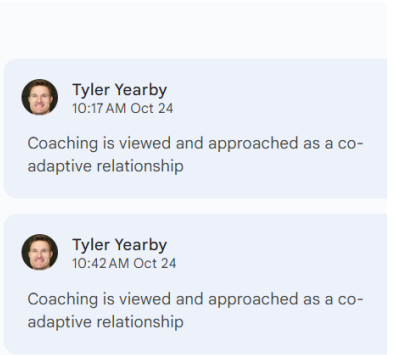
It has empowered patients to help co-create their own treatment. 8356-18

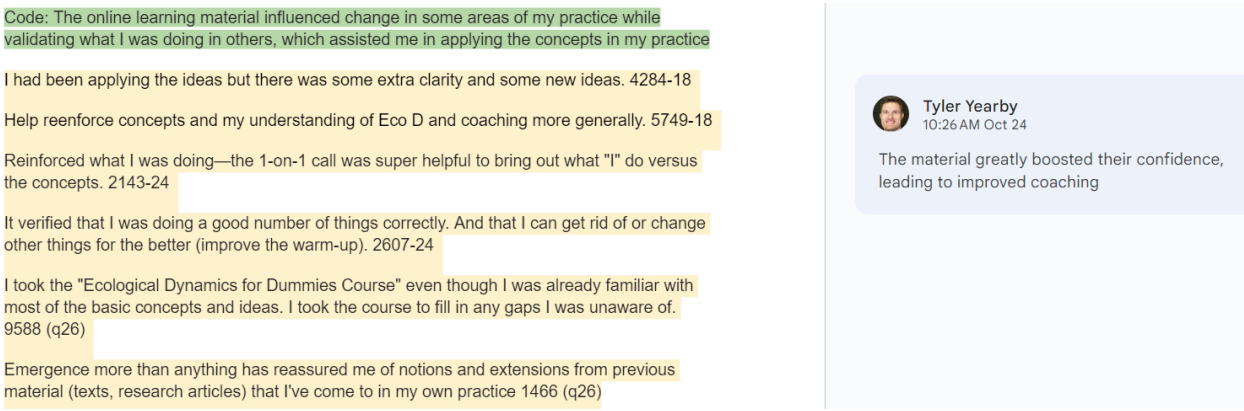
Ask more questions to players then I did when I started. 6960-18

I find myself asking my players more questions about how they perceive the task and the performance environment. 9478-18

Coadaptation has been something that I have really tried to incorporate into all aspects of training now. 5828-19

More flexible in approach with athletes and moving towards more co-designing. Using the athletes' experience of training and matches has really helped us develop the programme. Players have an increased sense of belonging and are ready to bring ideas to each session 9602-18





Other than analysis, below are the changes made between coding iterations one and two. The following 20 codes were dropped, and data extracts were relocated to other codes that had already been created and captured the meaning of the data.

Code: Different from the traditional way of learning

Code: Interest in creating a functioning interdisciplinary team

Code: Desire to approach coaching and training differently

Code: Seeing practical examples has been helpful in applying ecological ideas to bridge the gap between theory and practice

Code: Direct interaction with Emergence team members supported my development as a coach

Code: Increased reflection leads to a positive experience and a better understanding of why and how we coach

Code: More synchronous connections

Code: Community-wide homework with a platform for engagement

Code: In practice, understanding how to strike a balance between movement stability and variability is a work in progress

Code: Designing representative learning environments for sports I'm unfamiliar with is a challenge

Code: Tendency to overcomplicate practice design

Code: Creating a learning environment (including communication) to help athletes safely explore is a work in progress

Code: Working on finding a balance between providing knowledge about the game and allowing players to gain knowledge of it through exploration

Code: Exploration, authentic expression, and movement variability give rise to adaptability, helping individuals become better problem solvers

Code: Understanding more about the performer-environment relationship and constraint manipulation has helped my coaching

Code: With a better understanding of ecological dynamics and the CLA, I more effectively manipulate constraints to help facilitate skill adaptation

Code: Activities are more alive and representative now that I have a better understanding of ecological dynamics

Code: More thought is given to why an activity is chosen

Code: How I communicate is key

Code: I can more effectively apply ecological ideas in practice

Two additional coding changes

The following code was dropped along with the data because it did not directly assist in answering my research question. The information may be used during the discussion chapter.

Code: Working with remote clients is a challenge

The following code was dropped along with the data because it did not directly assist in answering my research question. The information may be used during the discussion chapter.

Code: Shifting one's mindset away from the rigid overcoaching of traditional coaching environments and towards ecological dynamics that promote authenticity and exploration

Appendix 3.4. Initial code and theme development examples from the semi-structured interview data analysis

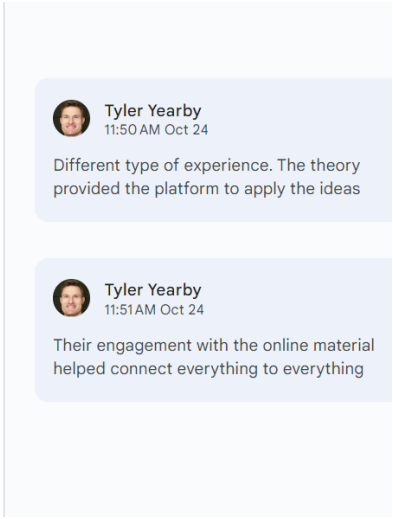
Early coding iterations

Code: Experience using ecological dynamics has been game-changing

It has kind of been game-changing. - Coach 1

I hadn't properly considered how I could apply these ideas in the weight room or for warm-ups. I knew that the traditional approach didn't align, but I didn't necessarily have the how-to to start shaping it and doing different things. For a few years, I've been really happy with how we were applying ecological ideas in terms of our style of play and the principles of play as opposed to game models, how we were practicing, and then you'd go to the weight room and you'd see very traditional things, you know, repetition after repetition. It really helped me connect the dots and understand how you can use an ecological approach to integrate every part of an organization, and I would say that where I'm at now is kind of seeing the game through a highly integrated organizational approach where you use ecological dynamics as a framework to tie the front office to coaching, athletic performance analytics, scouting, and everything else. I'd say that the whole journey to where I am now actually really did begin by looking at those courses because I realized it wasn't just in my field and coaching. I realized it went far deeper than that. - Coach 2

For me, applying the ideas that I learned through Emergence. It completely changed the way that I practice and how I look at things. - Practitioner 1

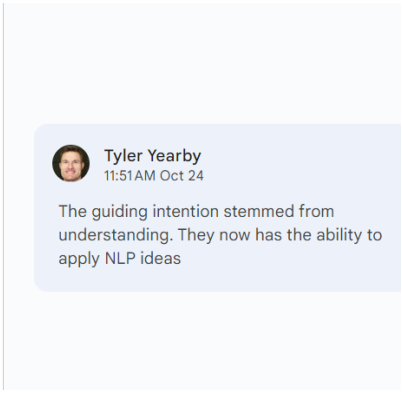


Code: More intentional when applying ecological ideas in practice / Now includes: Code: Increased confidence through online education and Code: Following a checklist keeps me true to an ecological approach

You know, whereas I got stuck before a lot where I was just doing stuff for the sake of doing it, where now I have, you know, there may be an intention for my lesson, and I can kind of, you know, test a few things out, maybe in the first 10 or 15 minutes in the warm-up, etc., to see is that even you know that part making the list. And then fine-tune [as] the lesson comes in. But always have the intention in mind. - Coach 1

I see the benefits of this approach. - Coach 1

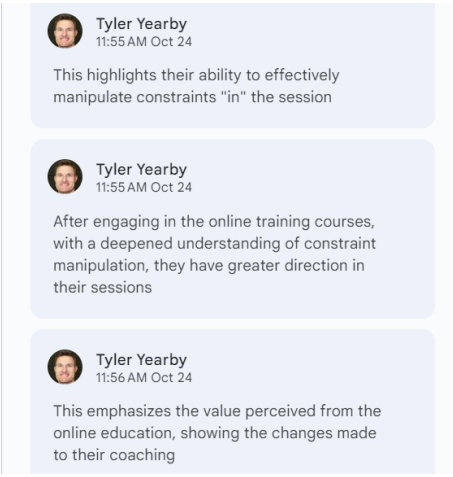
I think if I start avoiding that again, I'll go back to my old way. It's a real challenge and it makes you think about your planning a lot more. - Coach 1



We might use a random clock on different small-sided games, and that's obviously gonna change the intent and lead to different behaviors offensively and defensively emerging, changing scores, and changing what I call shrinking the space, so you know the space that they have will change rapidly during a possession or during a small-sided game. - Coach 2

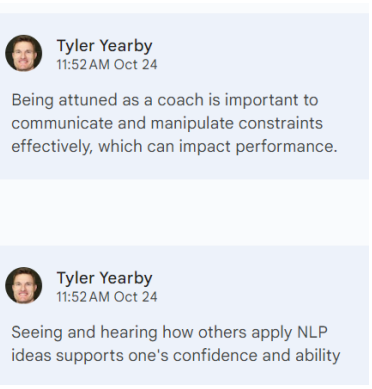
The conveyor belt is a practice methodology I developed this year where instead of always keeping players in the same spot, one coach's job is to constantly ensure that the players are moving around. These things have all emerged as a result of my understanding how to manipulate constraints. - Coach 2

I'm going through all these courses and applying these ideas because before I even knew what ecological dynamics was, or skill acquisition, or even constraint manipulation, it was always like, Oh, the fix. You just move differently in this picture that I have in my head, and it'll fix everything, when in reality, like I knew in the back of my head, there was more. But I didn't know. So understanding all of these underlying principles, I can start asking questions that are influenced by those underlying ideas to get more information from them and then have a more meaningful conversation. - Coach 5



I would say just being more creative and actually being more attuned to what was emerging within each activity—before, I felt like I had kind of a plan of the activities I wanted to use, which are definitely underpinned ecologically, but I wouldn't be as adept at being able to manipulate things on the fly. So I might let a whole activity run for 10 minutes, an obvious behavior might consistently have emerged, and I wasn't able to educate the intent of the players effectively or manipulate the constraints well enough to counteract and target what we were seeing. - Coach 2

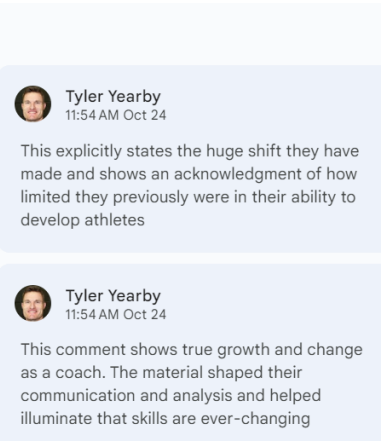
So I think what the courses have done for me, and just every time I engage with this material, I think it shifts me more and makes me more and more ecological, which is exactly what I want. So the more courses I consume, the more I see other people sharing how they are applying an ecological approach in their fields, especially outside of basketball. That's key. - Coach 2



Code: Viewing skill acquisition differently has inspired coaching changes

…the anxiety of being the, you know, the knowledge, kind of the knowledge keeper. I was the one who had all the knowledge, and it was my job to share that knowledge with the athletes, you know. And not letting them have their voice. - Coach 1

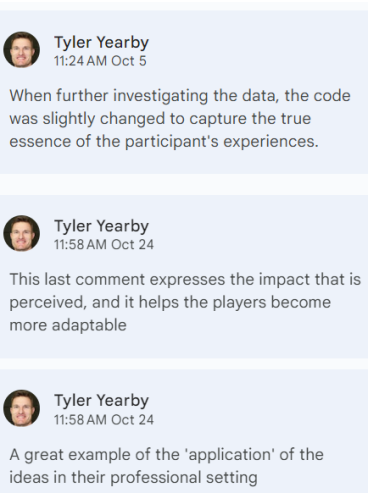
I think it was very easy to kind of say phrases or say lines that maybe sounded impressive to the actual, at least without really understanding what they actually meant in the context of what I was trying to maybe teach them. And I think now it's kind of, you know, you start with, you know, what is the intention? Where's the athlete at? At the moment and how can I actually help them to develop? - Coach 1



Code: Challenging individuals to become more creative and adaptable problem-solvers

I was coaching the players in terms of how to react, but as we know in football or any sport where situations change, every situation is different. My players were quite rigid in their problem-solving, so by being able to change the training environment and help them to solve, for example, if they're pressing high up the pitch to win the ball back and then kind of manipulating [the] environment to create many different situations, maybe where that underloaded or overloaded and different parts of the pitch, I felt I was giving my players more tools and how to solve [those problems]. - Coach 3

Maybe dial-up complexity; now they have less players, and this might be a situation again that they might meet. And suddenly, the complexity is high because they're outnumbered and have to pressure the defender in a different way, knowing that there are more attackers and more options to close down. - Coach 3

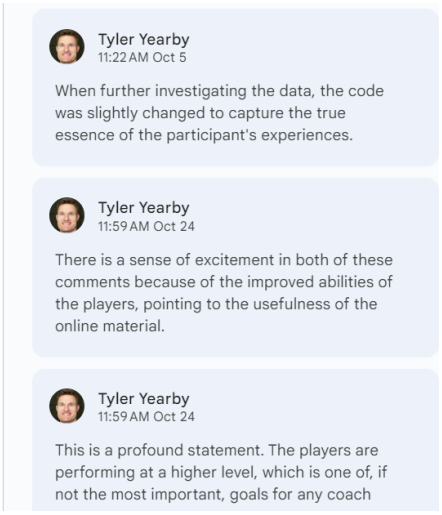


Code: Increased adaptability and more effective problem-solving

They do more scanning; they now see more targets. They also filter out what's important. They can decline any noise or any non-relevant information, and they can pick up the information in the environment. So that's really helpful for the athletes, you know, in the competition—there is not a lot of time, not a lot of space. - Coach 4

I noticed that the athletes make better decisions, faster decisions—if I can say alive decisions. It's how to pick up information from the environment even if I don't have the ball. I have a mission before I receive the ball. I have to scan, so I have my decision based on the alive information. - Coach 4

So this has been, for me, one of the most enjoyable and satisfying kind of after-effects of being completely bought into this framework. Whether it's enhanced dexterity or players being far better attuned to ways they can create advantages on offense or neutralize the offense on defense, players are becoming way more adaptable and actually having the confidence to go off script and not run a set play. - Coach 2

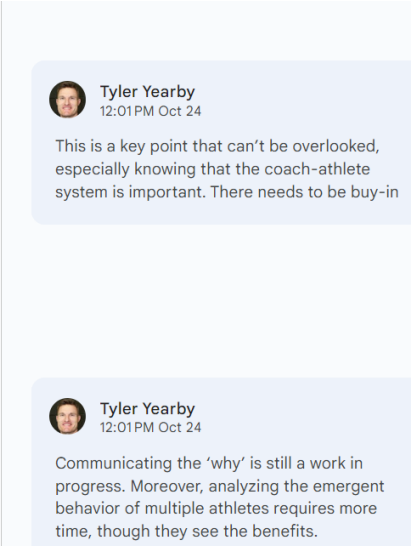


Code: Challenges when using different approaches to coaching

I think coaching players in this approach because they've come from maybe a more traditional linear approach where it was very top-down and coaches giving him a lot of information, almost a playbook in their head that they should be able to pull from whenever they want. I think that's been a big challenge for me—kind of getting to know the athlete. Look, where have you come from? What kind of coaching have you done before? And I suppose softly introducing, you know, that things are gonna be a small bit different. So I think that's #1.

#2: then is a challenge I find is that other coaches in my club wouldn't really be familiar with this kind of particular way of trying to coach. You know, I think trying to change particular models of coaching can be very, very difficult. I think that collaborating with them is quite difficult, to be perfectly honest. I think a lot of coaches are stuck in their ways and they find it very hard to change. This is more riskier because you have to think on the spot a lot. - Coach 1

A couple of my athletes have a different coach, and they've been coaching with that different staff, so they have different points of view. Also challenging is how to analyze the game—how to analyze 11 athletes inside the field in soccer. So it's challenging for me as a coach alone. I need more coaches with the same point of view to help me. - Coach 4



Appendix 3.5. Evolving survey data analysis: theme development examples

Candidate theme: Coaching changes (harnessing the power of the performer-environment relationship)

Code: By understanding more about the performer-environment relationship and constraints that shape behavior, my session design (and constraint manipulation) has improved to meet individual learner needs

I am constantly second-guessing myself in a healthy way. Asking myself, "could I have approached this better?" I feel much more "free" as a coach. I am no longer hyper-focused on mechanics but am much more aware of the surroundings and the interactions between the athlete, their task, and the environment they are in. Instead of trying to fit athletes into molds, I can understand that each athlete is truly unique. 9673-18

I have been more aware of the multiple variables when it comes to movement and skill acquisition. I shifted my thought process to not be driven by pieces of a movement and more of keeping the movement paired together. 3521-18

I have began to view everything through the lens of constraints. Working across a variety of sports, I am curious in the similarities and differences in behaviour across sports - why do athletes move differently in AFL compared to Rugby, for example. Viewing sports as a set of constraints acting on a player or group of players has really enhanced my coaching eye. 5828-18

Tyler Yearby
8:53 AM Oct 24

Understanding movement behavior at a deeper level supports constraint manipulation in practice

Tyler Yearby
8:59 AM Oct 3

These show they are aware of their gaps and express their willingness to make change and grow

Comments above copied from original document

I am more aware of the value and what the constraints I am using mean to the desired outcome. 2607-18

With a clearer view of the major concepts and principles, it allows me to design more effective environments for my athletes. 8610-18

I am more aware of the "drills" I use. 2496-18

The greatest impact was gaining increasing confidence to create my own donor sports playbook and begin to feel I had the capacity to design constraints and environments in my own way and with the kids. 7517-18

I have noticed a deeper understanding of ecological dynamics principles and have a greater idea of how to apply them in practice. 8499-18

Tyler Yearby
9:01 AM Oct 3

They are seeing movement from a completely different perspective, which inspires coaching changes

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Tyler Yearby
9:03 AM Oct 3

They are more adaptable in-session when manipulating constraints

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Practices evolved to consider more aspects of constraints based training. 0385-18

More aware of how the environment affects my players. 6960-18

I view my role not as providing highly explicit instructions as to how an athlete should move in sport, rather as purposefully manipulating constraints as to 'set the table' for which one's relationship with that environment may be enhanced by learning to perceive affordances and successfully act on them. 7851-18

I am even more aware of the relation of the training environment to the actual real game environment, allowing me to analyse and reflect on the task constraints I add into practice (and them of the environmental constraints too) and how they impact learning. 2672-18

Setting up meaningful practice sessions as well as guiding individual athletes. 9588-19

Being able to scale practices/training sessions based on where the athlete is at and what they need. 9673-19

My strengths definitely reside in analyzing the performer-environment relationship while identifying all the potential variables that could be explored to allow athletes to increase their dexterity. 1466-19

Being able to integrate a phase shift within a session to a skill vs waiting for a particular timeline to do so. 3521-19

Tyler Yearby
9:04 AM Oct 3

They have a deeper understanding of the p-e relationship

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Tyler Yearby
9:06 AM Oct 3

They have a deeper understanding of individual differences and the nonlinearity of learning, which has supported the changes in their professional practice

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My drills have become more diverse and adaptable. 8343-19

I feel like I have developed coaching superpowers. I listen more intently; I sense the response of the athletes and flex. I am more adaptable and can respond effectively to things. 9474-19

Being able to individualise the tasks, Developing more intelligent players in the game. 4284-19

I feel one of my strengths is my creativity in using constraints in practice. Through a lot of previous exploration, and also from my discussions with the Emergence tutors, I am able to use a variety of task constraints to construct rich 'real game-like' problems for the players to interact with. 2672-19

It has helped me be a better coach through an understanding of the complexities that exist in a sporting environment. 7018-21

I am definitely always questioning how and why I am doing a drill/game. 2607-24

I approach the warm-up differently now 2419-24

It gives a clear reference to the ways in which you can challenge an athlete 7018-24

Tyler Yearby
9:09 AM Oct 3

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Tyler Yearby
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With a greater understanding of the p-e relationship, more consideration is given to practice activities

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I no longer consider it a "good" practice only if it is clean-looking. I am far more comfortable with a messy practice being productive and useful than I used to be. 5422-24

It has given me additional knowledge and methods to expand the way the athletes I work with train. 3271-24

Is there a constraint that will teach it instead of me telling? 2607-24

Online material has given me confidence in the framework and a starting point to try 9602-24

It has helped me understand my practice design better and reflect after practices on why the activities worked or did not work and how I could change them 2496-24

Through opening my eyes to a different and more creative way of coaching that engages more people to learn 9034-24

Emergence and "Underpinnings" specifically have helped me understand ecological dynamics principles to a greater degree, which has allowed me to apply these concepts more effectively. For example, constraint manipulation and representative learning design 8499-24

Tyler Yearby
9:11 AM Oct 3

These are major shifts in their coaching that show their willingness to improve the skills of the athletes they partner with

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I now feel I need a greater depth of knowledge across all approaches to skill acquisition. 9034 (q26)

The amount of material provided and the encouragement and feedback on my use of it in the field have been immensely helpful. 2419 (q26)

Linking theory to practice is huge for me, especially with the intention of my lessons. 1697 (q26)

After taking these courses, I feel more confident in sticking with ecological theories when session planning and discussing training plans with my athletes 9588 (q27)

Better understanding of how to create representativeness through constraining the individual, the task, or the environment 7018 (q27)

Tyler Yearby
9:19 AM Oct 3

The courses helped provide a theory-practice link

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I wasn't as aware of how important the environment was before the class, so I can now see things more through that lens. 6283 (q27)

My practice designs, in-session coaching, and post-session reviews look and sound more like they would for someone living and breathing within this framework. 7851 (q27)

I feel better equipped now in understanding how my own coach behaviour, how task constraints, and how other constraints can impact the environment in which the player trains and plays in. 2672 (q27)

It is now no longer a 'shot in the dark' when I manipulate constraints. I have a greater self-realisation of why 'I need to change this constraint' and the benefits behind it. In the past, maybe my manipulation of constraints was more random than related to the session intention. Furthermore, I feel I am better attuned to HOW the player interacts with these constraints. 2672 (q28)

Prior to engaging with the material at Emergence, I would constrain to constrain (randomly), now I manipulate constraints with more thought and intention 8499 (q28)

The Emergence online learning material increased my confidence when applying constraints in practice due to the scientific concept and the evidence that I saw. 0522 (q28)

By having a theoretical understanding of constraints, I feel much more capable and intentional with their manipulation. 2419 (q28)

9:21 AM Oct 3

Key point that inspired change

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Tyler Yearby
9:21 AM Oct 3

Guidance was the key to doing

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Tyler Yearby
9:23 AM Oct 3

Understanding movement behavior at a deeper level supports constraint manipulation and RLD in practice

Code: Improved skilled movement analysis

How I view and analyze/study sport teams and athletes as complex, adaptive and open systems self-organizing under constraints; how perceptions, cognitions, and actions are highly interconnected and support the emerging movement being observed. 7851-18

When observing players in training and games, I am more cognizant of their intentions and attention. 2672-18

Analyzing the unfolding/emergent movement behavior under both internal and external constraints that channel that behavior. 7851-19

This has also had a positive impact on when I analyse and watch games at the highest level in my sport. I now watch to find common problems players face and consider how I can design practices to help develop younger players' abilities to interact with these problems. 2672-24

Tyler Yearby
9:35 AM Oct 3

With a better understanding of constraints on behavior, they are now viewing movement differently. The numerous examples of analyzing behavior in the online courses likely helped

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Code: Collaboration "opens up" opportunities; dialogue with performers is important

My coaching is much more of a two-way conversation now. I work with the athlete to forge a path forward. 5422-18

It has empowered patients to help co-create their own treatment. 8356-18

Ask more questions to players then I did when I started. 6960-18

I find myself asking my players more questions about how they perceive the task and the performance environment. 9478-18

Coadaptation has been something that I have really tried to incorporate into all aspects of training now. 5828-19

More flexible in approach with athletes and moving towards more co-designing. Using the athletes' experience of training and matches has really helped us develop the programme. Players have an increased sense of belonging and are ready to bring ideas to each session 9602-18

Now I feel empowered by the practice design, which allows the practice to flow and allows athletes to be co-creators of their own learning and feedback. 7517-18

More of a collaborative/ co-pilot with the athletes. 3521-21

Tyler Yearby
9:39 AM Oct 3

The online courses have inspired coaching changes where their approach has shifted to a co-adaptive relationship

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Reply or add others with @

Code: Communication is easier and more concise with players and coaches

More aware of my verbiage and the way I present information to players. 0385-18

This also links into my own communication with them when I might use verbal instruction to direct attention or intentions. 2672-18

Being able to guide the attention of the athlete and influence their intentions. Asking the athlete deeper questions instead of just giving them the perfect answer. 9673-19

The ability to ask better questions and help guide athletes to explore and take into account feedback. 8610-19

I'm more concise in my communication with the coaching staff about the EcoD ideas. 3755-19

It has afforded me tremendous opportunities to effectively communicate with both players and coaches. It has allowed me to recruit coaches and players as agents in their own skill development journey. 9478-19

Communication. 7219-19

More interaction with athletes, Better questioning style. 1697-19

Language is powerful

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Tyler Yearby
9:45 AM Oct 3

After engaging with the Emergence online education material, they are able to guide their athletes (and coaches) differently, and it seems they understand the importance of authentically connecting with the world around them

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Candidate theme: Ability (confidence supports application)

Code: Practice design and coaching now have a "why," which aids in attempting to achieve the objective

It made me more confident on that my ideas how take theory into practise / It increased my confidence in my ideas for putting theory into practice. 4755-21

The learning material helped me deepen my understanding and lend some structure to some ideas that have bounced around in my head. 5422-21

Before engaging with the online learning material, I did not know how to put these ideas into practice. Afterwards, I figured it out. 5422 (q27)

It helped simplify and highlight different ways to utilize the ecological approach. 3271 (q27)

Tyler Yearby
11:42 AM Oct 4

This is a key to having the ability to apply ecological ideas in practice

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Tyler Yearby
11:48 AM Oct 4

This seems to be the golden thread

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Tyler Yearby
11:49 AM Oct 4

The online learning material was the bridge to bring the ideas to life in practice

Code: With a better understanding of ecological dynamics and guided by practical examples, I feel comfortable and confident in my coaching and practice design

It has shared real-world applications of ecological dynamics and a constraints-led approach. Insights into games and examples of task constraints have all been helpful in operationalising an ED approach. 5828-21

Helped with real-world examples and in-depth reasoning. 0385-21

It's given me an opportunity to see how other practitioners apply the concepts of ecological dynamics in sport. 0162-21

Very helpful, being the best resource in ecological dynamics. They give practical examples from their experience in coaching. 1867-21

It has given case examples that can act as a starting point from which to explore further. For example, with the warm-up ideas—the examples given are great—I can make minor tweaks to gradually create new games or co-create new games with players to provide the stimulus that I want. 5828-24

The material was quite good. I liked the practical courses and seeing how the team members implemented their ideas 4284-24

Deeper dives into how the practical overlays the science behind it 2143 (q26)

There have been plenty of practical examples on your site to help. 6960 (q27)

Tyler Yearby
12:01 PM Oct 4

Examples were key to them making a change to their professional practice

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Candidate theme: Providing a platform for adaptability (prioritizing exploration and authenticity)

Code: Movement authenticity, exploration, variability, and problem-solving are prioritized

I feel my own coaching intentions are now more centred on guiding the player to be more adaptable and efficient at solving problems in a variety of ways, rather than producing the one solution that I believe would be best to solve this problem. 2672-18

Adaptability is so important, and creating a safe space where errors are embraced is so important for growth. 5828-19

The need to apply additional variability and task demands relatable to an athlete's specific sport and its demands. 3271-19

Variability is embraced, and creative solutions to movement problems can be embraced. 8356-19

Know that the athletes are learning and are problem solving without being coached or spoken to every second. 0609-19

Tyler Yearby
12:39 PM Oct 4

This is a critical change in perspective that can have positive outcomes for the athletes' movement

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Tyler Yearby
12:42 PM Oct 4

Variability is seemingly being embraced now after the online course interactions

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Tyler Yearby
12:40 PM Oct 4

There is a sense of accomplishment and relief in this statement

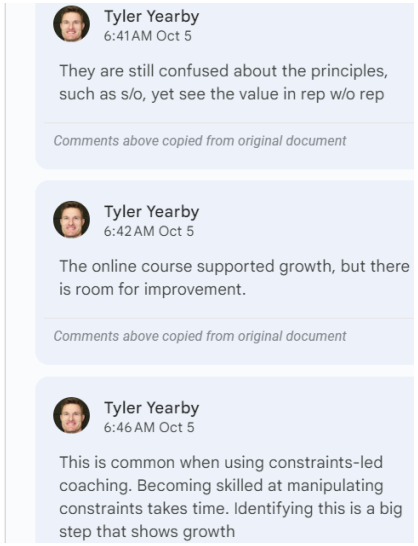
Candidate theme: Challenges and opportunities when implementing new ideas

I am also wondering how to effectively attain enough volume of stimulus to be effective at motor patterning while adhering to a repetition without repetition strategy. 8343-23

Sometimes there is a tendency to overthink and overcomplicate practice design. 8768-23

I think my knowledge has definitely increased, but becoming more aware of the ecological dynamics concepts has also shown me all the areas that I don't fully understand, and I now feel like I have even more to learn. To be fair, I generally feel this way about almost anything I learn. I might figure one thing out but I also find three new things around that new concept that I have to learn. I keep figuring out more things I don't know. 8343 (q28)

I still struggle sometimes with the concept of "constraining to afford." I conceptually understand what a constraint is, but sometimes it's very difficult for me to guide an athlete in a particular direction with their movement skills. 5422 (q28)



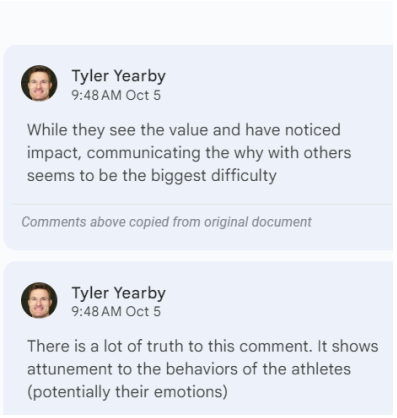
Candidate theme: Challenges and opportunities when implementing new ideas

I am not sure if this is a "weakness" or should more properly be called a challenge, but creating parent buy-in remains my primary struggle in applying ecological dynamics. Parents are conditioned to sign their child up for a specific "sport"—often revolving around their own sporting interests. 7517-23

To the parents who watch my practices, it may look like all we do is play games and don't work on specific skills. I obviously know this is incorrect, but for those that are not trained in this approach, it can look like a hands-off approach. I know many of the coaches I work with feel like this approach eliminates the need for coaches. 6960-23

Furthermore, getting a player to realize and trust that emergent behavior is a key part of skill development is a conversation that requires the practitioner to have an in-depth understanding of the field. 2419-23

Not having the answers that players sometimes want without going back to the traditional approach (i.e., the player wants to know "how"). 1697-23



Appendix 3.6. Survey informed consent form

Informed Consent Form	Yes	No
Do you understand the area of research you are answering survey questions about?		
Do you understand the global research objective?		
Do you understand that I have asked you to participate in a research study by answering survey questions?		
Have you read and received a copy of the attached information letter?		
Do you understand that you are free to contact me to ask questions about this study?		
Do you understand that you are free to refuse participation or withdraw from the study at any time, without consequence, and that your information will be withdrawn at your request?		
Do you understand that we will keep your data confidential?		

Signature: Date:

Appendix 3.7. University of Gloucestershire ethics approval

UNIVERSITY OF GLOUCESTERSHIRE
at CHELTENHAM and GLOUCESTER

Dear Tyler,

Thank you for your application for ethical approval.

I am pleased to confirm ethical clearance for your research following ethical review by the School of Sport and Exercise - Research Ethics Panel (SSE-REP).

Please keep a record of this letter as a confirmation of your ethical approval.

Project Title:	Investigating the Perceived Impact on the Professional Work of Sports Coaches and Practitioners After Completing Online Coaching Education Material Underpinned by Ecological Dynamics
Start Date:	September 2022
Projected Completion Date:	July 2024
SSE-REP Clearance code:	YEARBY21-22

If you have any questions about ethical clearance, please feel free to contact me. Please use your SSE-REP clearance code in any future correspondence regarding this study.

Best wishes

[redacted]

Stephen C. How PhD
Chair of School of Sport and Exercise - Research Ethics Panel

School of Sport and Exercise - Research Ethics Panel (SSE-REP)
University of Gloucestershire, Oxstalls Campus, Oxstalls Lane, Gloucester, GL2 9HW
Tel: 01242 715317
Email: show@glos.ac.uk

Appendix 3.8. Semi-structured interview invitation email

Greetings,

I am reaching out in the hopes that you might be interested in participating in the second stage of my doctoral research project. Your contributions in the first stage were very insightful, and I appreciate you taking the time to share your thoughts.

As a reminder, the purpose of my research is to investigate the perceived impact on the professional work of sports coaches and practitioners after completing online learning material (through Emergence) underpinned by ecological dynamics.

The online interview is entirely voluntary, although I hope you will consider assisting me because your experiences and views are important. The interview will be online and recorded, and along with your experience applying the ideas after interacting with the online education material, your location, position, and other information may be collected. You can withdraw at any time without a reason.

The data will be kept password-protected and only accessible to the research team. Anonymized excerpts about your experience might be used in my thesis. Any raw, non-anonymized data will be deleted as soon as the project ends. Anonymized data may be retained for future research purposes.

There are no right or wrong answers; it is about your experience, and the interview will be like a conversation. It will likely take between 15 and 45 minutes of your time.

Please let me know if you are interested in participating and what dates and times work best for you.

Many thanks, Tyler Yearby, M.Ed.

Appendix 3.9. Survey information sheet and privacy policy

Dear study participant,

Thank you for your interest and your participation in my research study. This study is voluntary, and the information you provide will only be included with your permission. The purpose of my research is to investigate the perceived impact on the professional work of sports coaches and practitioners after completing online coaching education material underpinned by an ecological dynamics rationale.

The first stage of data collection is a survey, and the second stage is a semi-structured interview. You are not required to be involved in both phases, but after completing the survey, you may be selected and asked to participate in an interview.

Along with your experience coaching after engaging with the Emergence education material, information about your gender, age, ethnicity, location, coaching position, and background may be collected.

All the data that is disclosed will be private and confidential. The data will be kept password-protected and only accessible to the research team. Any raw, non-anonymized data will be deleted as soon as the project ends. Anonymized data may be retained for future research purposes.

Many thanks,

Principal Investigator:

Tyler Yearby, M.Ed.

TylerYearby@glos.ac.uk

University of Gloucestershire, Oxstalls Campus, Gloucester, GL2 9HW

Appendix 3.10. Semi-structured interview information sheet and privacy policy

Dear study participant,

Thank you for your interest and your participation in the second stage of the research study. The interview is voluntary, and the information you provide will only be included with your permission. The purpose of my research is to investigate the perceived impact on the professional work of sports coaches and practitioners after completing online coaching education material underpinned by an ecological dynamics rationale and applying the ideas in practice.

The second stage is a semi-structured interview, which is an opportunity to learn more about your applied experiences after completing online coaching education from Emergence.

Along with your experience coaching after engaging with the Emergence online education material, information about your racial or ethnic origin, sex, age, location, coaching position, and background may be collected.

All the data that is disclosed will be private and confidential. The data will be kept password-protected and only accessible to the research team. Any raw, non-anonymized data will be deleted as soon as the project ends. Anonymized data may be retained for future research purposes.

Many thanks,

Principal Investigator:

Tyler Yearby, M.Ed.

TylerYearby@glos.ac.uk

Appendix 3.11. Semi-structured interview informed consent form

Informed Consent Form	Yes	No
Do you understand the area of research you are being interviewed about?		
Do you understand the global research objective?		
Do you understand that I have asked you to participate in a research study by answering interview questions?		
Have you read and received a copy of the attached information letter?		
Do you understand that you are free to contact me to ask questions about this study?		
Do you understand that you are free to refuse participation or withdraw from the study up to one month after you have completed the interview, without consequence, and that your information will be withdrawn at your request?		
Do you understand that we will keep your data confidential?		

Signature: Date:

Appendix 3.12. Semi-structured interview purpose and schedule

Interview purpose

The purpose of this interview is to understand any changes after engaging with and applying the ideas covered in the Emergence online education material, which is underpinned by a contemporary approach to skill acquisition. Additionally, I am interested in learning about any strengths or limitations you noticed. Finally, I am curious if your confidence as a practitioner has been impacted.

Terms of confidentiality

Thank you for your interest and participation in the second phase of the research study. This interview is voluntary, and the information you provide will only be included with your permission. Information about your location, coaching position, experience, and additional background information may be collected. The interview will be recorded so that the information can be transcribed and the data can be analyzed.

All the data that is disclosed will be private and confidential. The data will be kept password-protected and only accessible to the research team. Any raw, non-anonymized data will be deleted as soon as the project ends. Anonymized data may be retained for future research purposes. Finally, you may end the interview at any point and for any reason.

Interview format

This interview is semi-structured, meaning I have fixed questions, but I do not have a particular order I will ask them after the first question. The goal is to have the conversation flow naturally. Please feel free to elaborate as you would like, and I may ask follow-up questions.

Interview duration

This interview length generally ranges from 15 to 30 minutes, and as a reminder, you may end the interview at any point and for any reason.

Contacting the research team

If you need to contact us for any reason, you can email tyleryearby@glos.ac.uk

Do you have any questions?

Do I have your permission to record?

Semi-structured interview questions:

1. Can you please start by telling me a little about yourself, such as where you are located and the population you work with?
    - Length of time coaching/practicing
    - Is there any additional background you'd like to share?

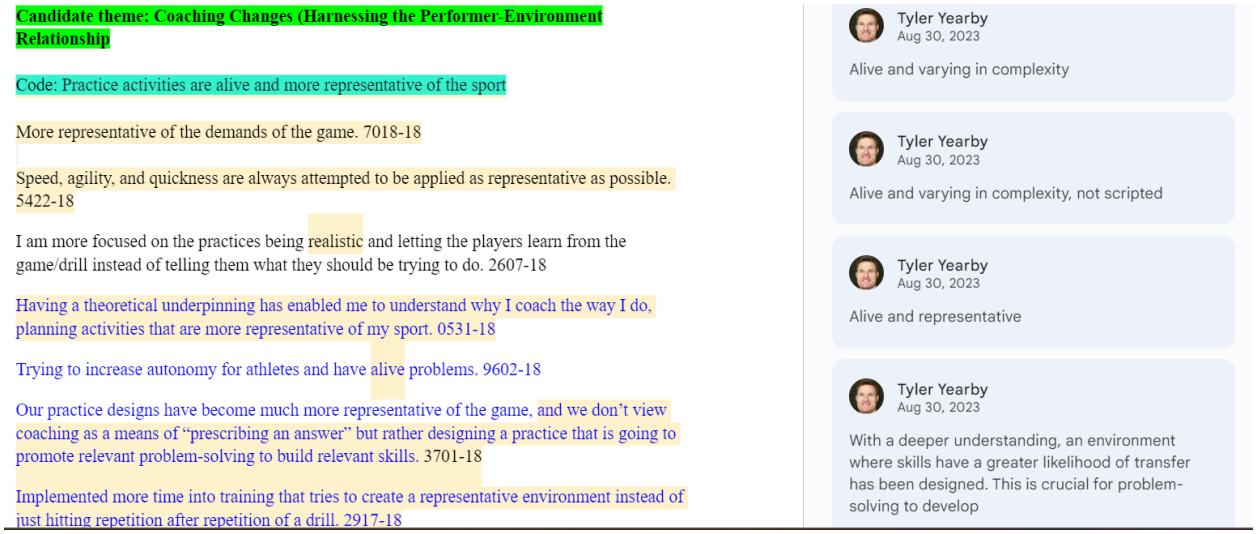
2. From the information you engaged with during the course(s), what was your experience like when applying the ideas in practice?
    - In what areas have you noticed changes in your coaching?
    - What has been most helpful in aiding your ability to facilitate sessions?

3. In what areas of your practice do you feel more confident?
    - Less confident

4. In what areas of your practice have you noticed the most improvement?
    - Biggest challenges

5. What changes have you noticed in the movement skillset of the athletes/individuals you partner with in training?

Appendix 3.13. Examples of amalgamating the survey and semi-structured interview data



Candidate theme: Coaching Changes (Harnessing the Performer-Environment Relationship

Code: Practice activities are alive and more representative of the sport

More representative of the demands of the game. 7018-18

Speed, agility, and quickness are always attempted to be applied as representative as possible. 5422-18

I am more focused on the practices being realistic and letting the players learn from the game/drill instead of telling them what they should be trying to do. 2607-18

Having a theoretical underpinning has enabled me to understand why I coach the way I do, planning activities that are more representative of my sport. 0531-18

Trying to increase autonomy for athletes and have alive problems. 9602-18

Our practice designs have become much more representative of the game, and we don't view coaching as a means of "prescribing an answer" but rather designing a practice that is going to promote relevant problem-solving to build relevant skills. 3701-18

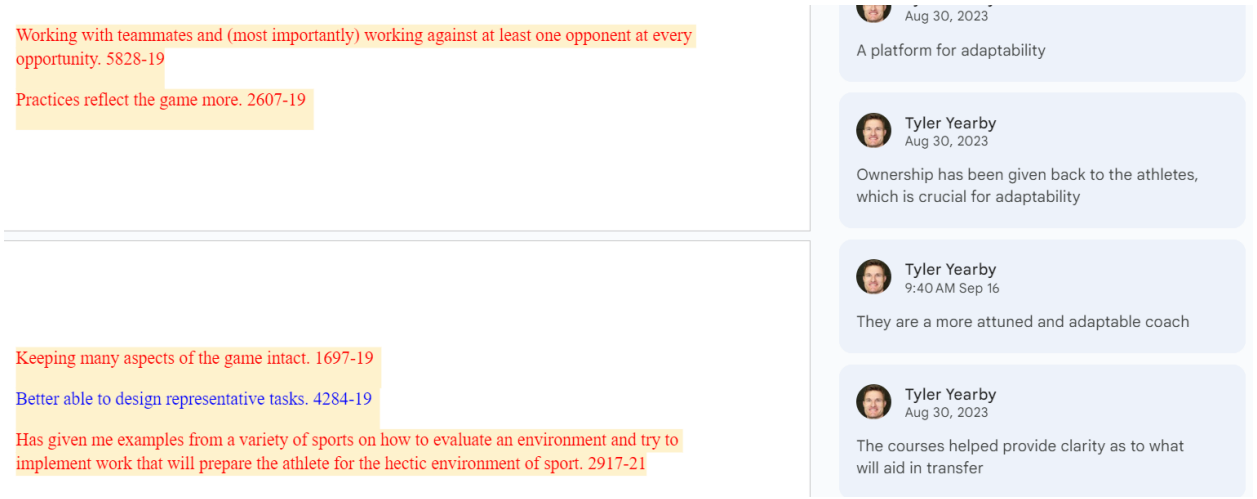
Implemented more time into training that tries to create a representative environment instead of just hitting repetition after repetition of a drill. 2917-18

Tyler Yearby
Aug 30, 2023
Alive and varying in complexity

Tyler Yearby
Aug 30, 2023
Alive and varying in complexity, not scripted

Tyler Yearby
Aug 30, 2023
Alive and representative

Tyler Yearby
Aug 30, 2023
With a deeper understanding, an environment where skills have a greater likelihood of transfer has been designed. This is crucial for problem-solving to develop



Working with teammates and (most importantly) working against at least one opponent at every opportunity. 5828-19

Practices reflect the game more. 2607-19

Aug 30, 2023
A platform for adaptability

Tyler Yearby
Aug 30, 2023
Ownership has been given back to the athletes, which is crucial for adaptability

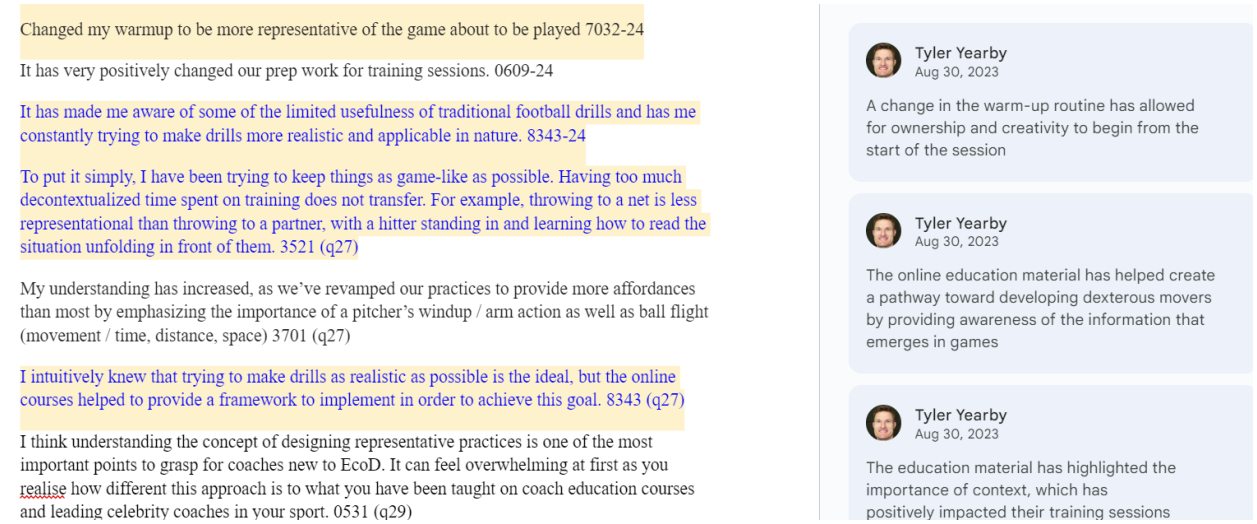
Keeping many aspects of the game intact. 1697-19

Better able to design representative tasks. 4284-19

Has given me examples from a variety of sports on how to evaluate an environment and try to implement work that will prepare the athlete for the hectic environment of sport. 2917-21

Tyler Yearby
9:40 AM Sep 16
They are a more attuned and adaptable coach

Tyler Yearby
Aug 30, 2023
The courses helped provide clarity as to what will aid in transfer



Changed my warmup to be more representative of the game about to be played 7032-24

It has very positively changed our prep work for training sessions. 0609-24

It has made me aware of some of the limited usefulness of traditional football drills and has me constantly trying to make drills more realistic and applicable in nature. 8343-24

To put it simply, I have been trying to keep things as game-like as possible. Having too much decontextualized time spent on training does not transfer. For example, throwing to a net is less representational than throwing to a partner, with a hitter standing in and learning how to read the situation unfolding in front of them. 3521 (q27)

My understanding has increased, as we've revamped our practices to provide more affordances than most by emphasizing the importance of a pitcher's windup / arm action as well as ball flight (movement / time, distance, space) 3701 (q27)

I intuitively knew that trying to make drills as realistic as possible is the ideal, but the online courses helped to provide a framework to implement in order to achieve this goal. 8343 (q27)

I think understanding the concept of designing representative practices is one of the most important points to grasp for coaches new to EcoD. It can feel overwhelming at first as you realise how different this approach is to what you have been taught on coach education courses and leading celebrity coaches in your sport. 0531 (q29)

Tyler Yearby
Aug 30, 2023
A change in the warm-up routine has allowed for ownership and creativity to begin from the start of the session

Tyler Yearby
Aug 30, 2023
The online education material has helped create a pathway toward developing dexterous movers by providing awareness of the information that emerges in games

Tyler Yearby
Aug 30, 2023
The education material has highlighted the importance of context, which has positively impacted their training sessions

Code: Viewing skill acquisition differently has inspired coaching changes

More patient with skill development. 7032-19

I am required to be more patient and let them learn their way. 2607-19

Patience, for sure. Understanding and applying ecological dynamics has given me the patience to let the athletes and environment "work" and not feel the need to verbally instruct or correct. In turn, this has given me an opportunity to pay closer attention to nuances of the training sequence, and think about changes to rules, equipment, tasks, and feel more attuned to practice. In the past, practice felt like a panicked attempt to ensure athletes received enough feedback/correction that I felt constantly out of time, exhausted, and overextended. Now, I feel empowered by the practice design to allow the practice to flow and for athletes to be co-creators of their own learning and feedback. 7517-19

My coaching is much more of a two-way conversation now. I work with the athlete to forge a path forward. 5422-18

Data from numerous codes that were created during my survey analysis was relocated here during the amalgamation of the datasets because it better captured what had been stated.

Tyler Yearby
8:50 AM Nov 15

This was moved from a previous phase of analysis because its meaning is better captured by this code

These statements illuminate skill as a search and learning across varying timescales. These are radical shifts for coaches, highlighting the impactfulness of the material.

Show less

Reply or add others with @

I am constantly second-guessing myself in a healthy way. Asking myself, "could I have approached this better?" I feel much more "free" as a coach. I am no longer hyper-focused on mechanics but am much more aware of the surroundings and the interactions between the athlete, their task, and the environment they are in. Instead of trying to fit athletes into molds, I can understand that each athlete is truly unique. 9673-18

I have been more aware of the multiple variables when it comes to movement and skill acquisition. I shifted my thought process to not be driven by pieces of a movement and more of keeping the movement paired together. 3521-18

I have began to view everything through the lens of constraints. Working across a variety of sports, I am curious in the similarities and differences in behaviour across sports - why do athletes move differently in AFL compared to Rugby, for example. Viewing sports as a set of constraints acting on a player or group of players has really enhanced my coaching eye. 5828-18

I think more about how my players interact with the environment (external) versus how they think to move (internal). 2143-18

Viewing skill and player interactions from a completely different perspective. 0531-18

Tyler Yearby
Sep 4, 2023

Positive impact was noticed in several areas, most notably the value of the performer-environment relationship

Tyler Yearby
Sep 4, 2023

Value was perceived; abandoning a "part" approach is a huge shift in coaching

Tyler Yearby
Sep 4, 2023

This coach has noticed the importance of constraints shaping behavior, which has positively impacted their coaching

Emergence and "Underpinnings" specifically have helped me understand ecological dynamics principles to a greater degree, which has allowed me to apply these concepts more effectively. For example, constraint manipulation and representative learning design 8499-24

Program design better encapsulates player-led behavioural change. 0385-24

I'm better at designing environments using multiple constraints to elicit the certain skills or principles I'm looking for. I used to primarily view learning in a very linear way, and I understand better now that that is not always the best way to teach. 6960-24

Many of the materials I have reviewed from the non-discussion-based aspects of Emergence have provided me with more conceptual and theoretical frameworks. There were several useful worksheets provided along the way to help frame /design an ecologically driven practice. 9478-24

Tyler Yearby
Sep 5, 2023

A theory-practice bridge was created. There is a sense of accomplishment in this statement

Tyler Yearby
6:14 AM Jan 3

The material provided clarity

Tyler Yearby
Sep 5, 2023

There is now a reason why the constraints are manipulated and a realization that learning occurs over varying timescales

Tyler Yearby
7:15 PM Sep 15

"Bringing the ideas to life" is important to impact practice

When to modify and adapt along with how to build and progress the learning development of the athlete. 1867 (q28)

I know many more ways now of manipulating constraints such as time, space, rules etc. 6960 (q28)

I believe I am more sensitive to the potential constraints that may shape athletes' movement solutions, but I am far from masterful in manipulating them. I am still exploring the systemic relationships between constraints and my athletes. I am still only just beginning to scratch the surface of my own potential in recognizing these relationships as I watch film or even observe my players during a session. 9478 (q28)

Emergence has deepened my understanding of the importance of the performer-environment relationship and the information athletes may experience. This has allowed me to design my own environments, rather than copying others I see. 8499 (q29)

I think I just had to really kind of reset where I was and try to apply these ideas into my new kind of form of life. - Coach 1

I'm definitely talking a lot less [on the court] than I used to be. So it was, which is a big thing for me. I'm letting the players play a lot more. I think that's a massive thing that I just observe when I'm coaching this way as well, you know. It's in out very, very quickly. Off you go, in, out, get, get their feedback. - Coach 1

My practice designs, in-session coaching, and post-session reviews look and sound more like they would for someone living and breathing within this framework. 7851 (q27)

So after engaging with the content and from what I learned, I felt more in control of how I can manipulate the environment through constraints, representative learning design, and then also through my own interactions with players, not just in terms of [giving] them explicit information but in terms of directing their attention and their intentions—my questioning as well. - Coach 3

After attending Emergence Online Learning, I am able to improve my daily sessions and increase the benefit of each training. 0522-24

I

More reflection in every activity I do at practice. 2496-19

This has given me an opportunity to pay closer attention to the nuances of the training sequence, think about changes to rules, equipment, and tasks, and feel more attuned to practice. 7517-19

I have noticed that my ability to design training/learning environments has greatly improved. 8499-19

Applying principles of play in building better games for my practices. 6960-19

The last two seasons I've worked with a team that are at the bottom of the league, so confidence will be low in the games—they haven't been successful. How can I present a problem in training that they'll be able to solve successfully and adapt to? So especially when I have younger players, it's been effective in terms of modifying the training environment to make it realistic to the game on the weekend while still helping them to guide them to solutions and information that's present in the environment that I want them to attune to. - Coach 3

These comments speak to the impact noticed after engaging in the online learning material. This is important not only for answering the research question but also because purposeful constraint manipulation is critical for skill development.

Tyler Yearby
Sep 5, 2023

There is a significant change in their ability to coach (e.g., purposeful constraint manipulation)

Tyler Yearby
Sep 5, 2023

The online learning material has 'given' them the ability to make meaningful changes in their practice. A theory-practice bridge was created.

Tyler Yearby
Sep 6, 2023

They understands how important the change has been in their coaching, so athletes can move authentically to solve problems.

Tyler Yearby
Aug 23, 2023

A clear understanding of ecological dynamics and NLP bridged the gap in being able to apply the ideas in practice

Tyler Yearby
Sep 5, 2023

There was a noticeable impact

Tyler Yearby
Sep 4, 2023

The deeper point here is that they better understand constraints on behavior, which has improved their coaching ability

Tyler Yearby
Sep 5, 2023

The online material helped create a bridge between theory and practice.

Tyler Yearby
Sep 6, 2023

Coaching changes guided by the online learning material: E.g., athlete-centered, more equipped to scale complexity through constraints manipulation

The only thing in the pro scenario would be load management. In terms of the number of games, making practice representative enough on the low days has been one of my biggest barriers because I've really disliked traditionally what teams do on low days, where it's all five on zero. So for me, what I experimented with was using coaches as defenders and just running a shorter practice. So instead of, you know, doing something completely on air, we at least have something for them to attune to and get the coaches to understand that they're not being passive defenders; they're actually trying to force mistakes and be unpredictable and varied in terms of the affordances they're creating for the players. - Coach 2

Games have become more advanced and targeted on specific areas of development 9602 (q27)

What I found was that they embraced kind of problem-solving a lot more. Tennis [has] a big history of kind of like building consistency, not really playing matches. When they were using sessions where there was more representative, [or it] was manipulating constraints to get a lot more comfortable in those situations where they had to adapt or make decisions, I found that they started to enjoy those situations a lot more. - Coach 6

Tyler Yearby
Sep 6, 2023

They see the value in game-like learning situations enough to make small tweaks to provide the players with a chance to become one with their environment. The online courses showed the value of the p-e relationship

Tyler Yearby
Sep 6, 2023

Player buy-in supports the ability to make changes to the learning environment

The numerous examples throughout the courses and the ones shared on MMU assisted them to become more comfortable manipulating constraints in their sessions

Candidate sub-theme: Ability (Confidence Supports Application)

Code: The online learning material influenced change in some areas of my practice while validating what I was doing in others, which assisted me in applying the concepts in my practice

It verified that I was doing a good number of things correctly. And that I can get rid of or change other things for the better (improve the warm-up). 2607-24

Emergence more than anything has reassured me of notions and extensions from previous material (texts, research articles) that I've come to in my own practice 1466 (q26)

Before Emergence, I had a scholarly understanding of the principles of ecological dynamics. After working through several Emergence courses, scholarly knowledge evolved into one of fluency and functionality. I not only understood the vocabulary/theory but it became a part of who I was becoming as a coach. I was attempting action these principles within my own craft with youth athletes. My understanding as a result was deepening significantly. 9478 (q26)

Tyler Yearby
Aug 21, 2023

The online learning material helped refine the application of the ideas. This is important because adopting two different approaches to learning can be confusing and limiting to players

Tyler Yearby
6:33 AM Jan 3

The material provided clarity assisting with boosted confidence

Tyler Yearby
Aug 21, 2023

The application of the ideas was made possible after engaging in the online learning material. This is significant when looking to design learning environments and manipulate constraints purposefully

Code: There is a noticeable sense of community with other interested coaches

Emergence has provided me a community of people who I feel as though are fellow travelers and I can converse and learn with regardless of background. 1466-21

Helpful to connect with others. 6082-21

I had been applying some of the ideas of, say, ecological dynamics, or the constraints-led approach already, but because where I was, there wasn't many people or I didn't know anyone else applying the ideas and practice so, what Ifound that I probably had a knowledge of most of it already, but I found out that it was the Movement meet-up [calls] where you were able to bounce ideas off the other practitioners on the call. At the start there was quite small numbers in them and so it was a great opportunity to kind of discuss with the different people in the room ideas. And I found probably [those] most beneficial to do application of the ideas in everyday practice. - Coach 6

Tyler Yearby
10:13 AM Oct 3

The online platform facilitates interactions. A sense of community is critical for growth.

Tyler Yearby
Aug 25, 2023

Interacting with others helped give them the ability to apply the ideas in their own professional setting

Code: A deeper understanding of ecological dynamics opened up new opportunities, especially for practice design, and helped with confident and intentional coaching behavior

It has shared real-world applications of ecological dynamics and a constraints-led approach. Insights into games and examples of task constraints have all been helpful in operationalising an ED approach. 5828-21

Helped with real-world examples and in-depth reasoning. 0385-21

Tyler Yearby
7:02 AM Oct 15

New code created during the amalgamation of the data

Show more

Tyler Yearby
Aug 21, 2023

Practical examples of purposeful constraints manipulation are vital so coaches understand how to do it themselves

Tyler Yearby
6:32 AM Jan 3

The material provided clarity so they could 'apply' the ideas with confidence

For this coach, their confidence increased knowing the information they were learning about was peer-reviewed

This type of online learning is based on scientific references, so it makes me wanna learn more, and I'm confident. - Coach 4

After taking these courses, I feel more confident in sticking with ecological theories when session planning and discussing training plans with my athletes 9588 (q27)

Introduced a way to think about how athletes move and develop skills. It opened me up to all the different ways to think about what we are doing with our practice time and what can be learned in a game/drill. Rethinking the Warmup and Agility were the two courses that interested me the most. 2607-21

SMSC 2020 and 2021 were my introduction to ecological dynamics. So much good content there and practical examples to start the process of working this way. Recently the warm-up course also helped shift the way athletes got ready for sessions. The mix of theory and practical examples gets you closer to giving it a go yourself. 9602-21

Tyler Yearby
Sep 5, 2023

Increased confidence leads to an increased ability to see the depth of the framework, therefore positively impacting practice

Tyler Yearby
Aug 21, 2023

A clear why and how are vital as a point of departure

Tyler Yearby
Aug 21, 2023

A mixture of theory and practice is critical to applying ecological and NLP ideas

Candidate sub-theme: Providing a Platform for Adaptability (Developing Better Problem Solvers)

Code: Challenging individuals to become more creative and adaptable problem-solvers

It puts pressure on them to kind of create an environment where maybe they might succeed a bit more in that. To find new ways of figuring out problems, you know, so I think that's where I saw the big, big change. - Coach 1

They don't have me holding their hand every day, so they have to problem solve on their own. I tell you to explore, and I tell you to experiment. You were then able to problem solve, and now you have a better solution to the problem at hand. - Coach 5

Another thing I am more aware of is that each athlete is completely physically different and that means they need to find solutions that work for them. 2607-18

Tyler Yearby
Aug 31, 2023

This is an important mention. They noticed change, which means they made an impact

Tyler Yearby
Aug 31, 2023

This comment shows that the coach is proud of what they have done to help the athlete, emphasizing the importance of what they learned from the courses

Tyler Yearby
9:40 AM Sep 16

There is a sense of accomplishment in this comment, knowing they are helping the athletes get better. Additionally, there is an understanding of individual differences.

I now think more about the problems my players face and how I can design sessions that present these to the athletes and require them to solve them. This is different from the past, where I thought more of "concepts to teach," where the focus was more on them learning "my solution" rather than interacting with the problem more autonomously (yet guided) and developing their own unique novel solutions. 2672 (q24)

I think presenting different problems kind of helped to push the individuality of the player rather than before—they must move and act in this way because of how a typical player acts in this position. Whereas now, for example, I might have a defensive midfielder who is stereotypically big, strong, and tall, but now I have a smaller, quicker number 6 defensive fielder who can solve the same problems in their own unique way and still be effective. Yeah, it's about kind of nurturing the individuality of the player to kind of push them to solve the problems in their own way rather than before. - Coach 3

So for me, the change was basically instead of looking for some idealized movement, [um], I was much more willing to see some variation in how people moved and how they were trying to really solve their current movement problem. So whether or not it was walking or getting up from a chair, or negotiating some obstacles, I no longer was looking for this perfect movement solution. - Practitioner 1

Tyler Yearby
Aug 21, 2023

With a deeper understanding of the performer-environment relationship, affordances, and the movement problem-solving process, there was a drastic change in what coaching means. This "opens up" numerous opportunities for development (for both the players and coaches)

Tyler Yearby
Sep 6, 2023

This is a huge step towards helping to develop players, which is something they learned from the courses

Tyler Yearby
10:44 AM Nov 12

Inspired by the online course engagement, their coaching evolved from perfect execution to skill adaptability

Code: Increased adaptability and more effective problem-solving

The athletes I work with are better problem solvers. 0609-18

Our students learn faster. The learning sticks better (because the words don't get in the way). Their training transfers to the game better (the less they "think" the better they play). The skills they develop withstand psychological pressure. 8128-18

It has changed almost everything. Transfer from practise to the game is totally on a different level. 4755-19 (the first sentence was added during the amalgamation process)

Helpful, I have been having more engaged students and seeing more growth in skill. 9588-21

The goals are to develop dynamic sports teams and players, and I have experienced pleasant success and changes to perception and action capabilities by both the team and players 7851-21

Allowing better learning outcomes 7018 (q28)

Observing skilful interactions and players adapting right in front of me affirmed this was the right path to take & Players improved at a far greater rate than when I focused on mechanics and on-air coaching 0531 (q28)

Tyler Yearby
1:02 PM Oct 4

Skill adaptability is what most (if not all) coaches are looking for. These comments delineate the value they perceived from the

Show more

Tyler Yearby
7:33 AM Oct 15

While the value of the online learning material seems to lie beneath the surface in the comments, collectively, the coaches all noticed players performing more skillfully, which is crucial and a credit to the material they interacted with online

Candidate theme: Challenges Identified and Opportunities Illuminated to Improve Coaching Skills

Code: Difficulty fully committing to an ecological approach

At times, it is still hard for me to remove myself from the traditional approach I grew up with. Many times, I fall back on what I am used to and do not always think of applying the ecological approach. 3271-23

Initially, I dismissed all other concepts and saw this as the only way, which limited ability to influence and educate others. 9034-23

When there's a physiological "block" or issue, let's say soft tissue or limited ROM, I get in a tug of war where I think if it should matter or if I approach it in a more general sense and then apply the knowledge I've learned when working closer to the skill itself and not in pieces or pre-scripted movement. 3521-23

The last two comments were moved here from the code titled "Difficulty knowing when and how to scale the complexity of an activity to help someone adapt their skills" because, upon further analysis, it seemed to be a better fit.

Tyler Yearby
Sep 12, 2023

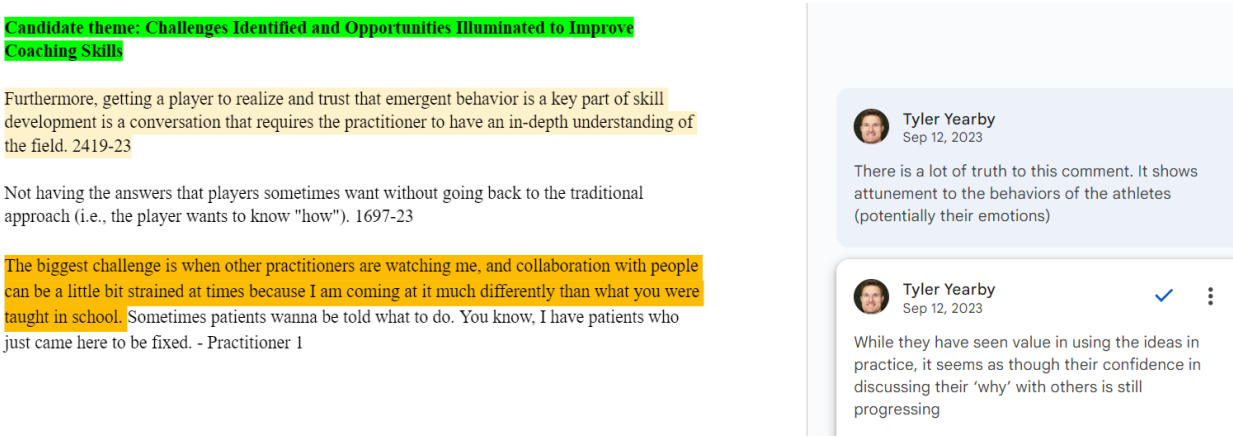
Coaching/thinking attractor

Tyler Yearby
Sep 12, 2023

They are still coming to know the ideas

Tyler Yearby
Sep 12, 2023

Deep thinking about how to approach coaching. Could it be a system issue?



Candidate theme: Challenges Identified and Opportunities Illuminated to Improve Coaching Skills

Furthermore, getting a player to realize and trust that emergent behavior is a key part of skill development is a conversation that requires the practitioner to have an in-depth understanding of the field. 2419-23

Not having the answers that players sometimes want without going back to the traditional approach (i.e., the player wants to know "how"). 1697-23

The biggest challenge is when other practitioners are watching me, and collaboration with people can be a little bit strained at times because I am coming at it much differently than what you were taught in school. Sometimes patients wanna be told what to do. You know, I have patients who just came here to be fixed. - Practitioner 1

The following codes were dropped during the amalgamation of the datasets, and the associated data was relocated to another code that better captured the meaning of the data.

Code (from SSI): More intentional when applying ecological ideas in practice

Code (from survey): I'm still learning to identify what skillful behavior is

Code (from survey): Working with larger groups is a challenge

Code (from survey): Skilled behavior takes time

Code (from survey): Movement authenticity, exploration, variability, and problem-solving are prioritized

Code (from survey): Learning and adaptability have increased

Code (from survey): By understanding more about the performer-environment relationship and constraints that shape behavior, my session design (and constraint manipulation) has improved to meet individual learner needs

Code (from survey): Collaboration "opens up" opportunities; dialogue with performers is important

Code (from survey): Focus and approach in the weight room has shifted

Code (from survey): My role has shifted to a player-centered approach to coaching, and "training" has taken on a new meaning

Code (from survey): Learning about ecological dynamics has opened up new opportunities

Code (from survey): Concise and digestible material; helpful in improving my practice

Code (from survey): A helpful perspective on coaching and skill development

Code (from survey): Finding a functional fit in representative environments is more important than isolated technique drills

Code (from survey): Practice design and coaching now have a “why,” which aids in attempting to achieve the objective

Code (from survey): With a better understanding of ecological dynamics and guided by practical examples, I feel comfortable and confident in my coaching and practice design

Code (from survey): I have a deeper understanding of skill development; new opportunities for practice design and coaching have been "opened up"

Code (from survey): Difficulty knowing when and how to scale the complexity of an activity to help someone adapt their skills

This following code, which was revised during the early stages of the amalgamation process, was dropped, and the associated data was moved to another code that better captured the meaning of the data.

Code (created early in the amalgamation process): Challenge points that offer opportunities to grow when using contemporary approaches to skill acquisition

The following code, which was developed during the early stages of the amalgamation process, was dropped, and the associated data was moved to other codes that better captured their meaning.

Code (revised early in the amalgamation process): There is room for improvement in my practice design and constraint manipulation (including

communication) as activities unfold; comfort and knowledge addressing skill development over different timescales are works in progress

Both of the following codes were moved from the Candidate sub-theme titled "Providing a platform for adaptability (developing better problem solvers)" to the Candidate theme titled "Coaching changes (harnessing the performer-environment relationship)" during the amalgamation process.

Code: Practice activities are alive and more representative of the sport

Code: Ownership and exploration lead to higher engagement and enjoyment