Integrating specificity and generality of practice to enrich children's learning in sport

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Integrating specificity and generality of practice to enrich children's learning in sport

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Abstract

Participation and high-performance sport systems have seen a shift towards early identification and selection of children into specialised training pathways in a single sport. The value of such sport systems continues to stimulate debate amongst academics and practitioners, highlighting the issues captured by the longstanding specificity versus generality of practice dualism. Specificity of practice involves learners engaging in repetitious practice of movement techniques in dedicated performance contexts in a targeted sport. Generality of practice, concerns providing learners with variable practice conditions (structured and unstructured learning experiences in different sports) to develop a repertoire of functional movement skills which can interact with later specialised training to enhance talent. This chapter critically evaluates the traditional approach of viewing specificity and generality of practice as counter positioned. Rather, we suggest the need to redress the imbalance that has emerged over the past 100 years in understanding how specific and general practice experiences can complement children's skills and talent development in sports. We outline an ecological dynamics rationale proposing the need for coaches to adopt a more nuanced balance between specificity and generality of practice, with both types of experiences being important at the right time in a child's development. Movement experiences can exist on a continuum of practice designs which children could be (re)located upon, depending on individual learning needs. Finally, we discuss how key principles of contemporary models of motor learning can be implemented by coaches and sports teachers integrating both types of practice experiences to satisfy the development needs of each child, whether seeking to specialise in sport on an elite pathway or to maintain long term recreational participation in sport and exercise from a health and wellbeing standpoint.

Keywords: specificity and generality of practice, scientific dualisms, enrichment, children's learning, physical literacy, coaching, motor learning theory

Introduction

Participation and high-performance sport systems have seen a shift towards early identification and selection of children into specialised training pathways in a single sport. This radical change has led to children's sport becoming increasingly professionalised in formalised athlete development programmes when they are still in primary education (i.e., 4 to 11 years). The value of such sport systems continues to stimulate debate amongst academics and practitioners, who have highlighted the challenges of early specialisation to the mental, physical, and social development of children and youth (Baker *et al.,* 2021). Indeed, an editorial in the British Journal of Sports Medicine, identified early specialisation in elite sports development programmes as a major threat to the health and wellbeing of future generations (Roetert *et al.,* 2018).

The fundamental problem of how to motivate, encourage and develop skills and talent in children without causing them mental, physical, and social harm, is framed in the longstanding *specificity versus generality* of practice dualism in motor learning (Ribeiro *et al.,* 2021). Specificity of practice involves learners engaging in highly repetitious drills in dedicated performance contexts to develop 'optimal' movement techniques for performance in a targeted sport. Too much specificity of practice may exacerbate intensity of specialised training in children. The result could be problems related to physical, psychological, and emotional loading and intensity (Forsman *et al.,* 2016). Generality of practice involves providing learners with variable play and practice experiences (structured and unstructured learning experiences in different sports (Coutinho *et al.,* 2016)) to develop a foundation of functional movement skills which can interact with later specialised training to enhance talent (Ribeiro *et al.,* 2021).

This chapter discusses the *complementary nature* of specificity and generality of play and practice experiences to enrich children's learning. These ideas highlight the importance of infusing variability and specificity of task constraints at appropriate times during children's learning. Principles of contemporary pedagogical models of learning, Non-linear Pedagogy (NLP) and the Athletic Skills Model (ASM), are discussed to highlight how they can be implemented by coaches and

sports teachers integrating both types of practice experiences. In this approach, the developmental needs of each child can be satisfied whether seeking to specialise in sport on an elite pathway or to maintain long term physical literacy for health and wellbeing benefits.

Review of Current Research

Motor learning has been one of the most relevant sub-disciplines to influence learning designs in sport coaching practice (Chow *et al.,* 2022). Traditionally, however, the motor learning domain was consumed in a heated debate about the putative nature of internalised, representational mechanisms for controlling movements (for reviews see Singer, 1975; Schmidt, 1982). As motor control and learning process theories developed, the *specificity vs. generality* debate emerged between the 1960s to 1980s, side-tracking understanding of both characteristics for motor learning principles for coaches and teachers. In the 1960s, this debate was centralised on key issues, such as whether an internalised movement representation was specific (a motor programme for each movement) or more general (a schema to control a class of movements such as locomotion, throwing, kicking, or catching) (Williams *et al.,* 1999).

These theoretical and empirical insights were adopted by applied scientists, motor learning specialists and sport pedagogy researchers focusing on examining the benefits and effects of *either* specificity or generality of learning experiences. However, the possibility that both types of experiences were of relevance for children's skill learning and development has rarely been considered, exemplifying a 'dualism' often observed in other areas of science. Indeed, the tendency to *juxtaposition* specificity and generality of play and practice experiences was also apparent in physical education, being highlighted in some of the most influential research papers published in the early years of the sub-discipline's development (Table 1). The word 'versus' in the title captures the thinking at that time.

Table 1: Scientific dualism in the titles of research papers focusing on investigating benefits of either specific or general learning, practice, and training experiences, rather than seeking to understand their complementarity:

Bachman, C. (1961). Specificity vs. Generality in Learning and Performing Two Large Muscle Motor Tasks. *Research Quarterly,* 32, 3-11.

Henry, F.M. (1958). Specificity vs. Generality in Learning Motor Skills. *Proceedings of College of Physical Education Association*, 61, 126-128.

Smith, L. (1973). Specificity versus Generality of relationships between individual differences in motor abilities. *Educational Perspectives*,12, 19-28.

In contrast to research programmes in physical education, sport science practitioners such as Anatoly Bondarchuk (1994, 2007) advocated a more nuanced understanding of general and specific experiences for learning and practice in sport. Bondarchuk's insights have important implications for understanding how to coach children, enhance their movement development, and prevent physical and mental problems common in early specialisation programmes. Bondarchuk (1994, 2007) proposed that more general training should be concerned with developing general athletic skills, whereas specific training is dedicated to performance enhancement and preparation in one sport. He advocated a unification of general and specialized preparation for sport performance, proposing a "…. principle of unity of general and specialized preparation" (Bondarchuk 2007, p.5). He noted that, experienced separately, each type of training has some benefits for athletes, but integrated together they provide a significant platform for athlete development. His ideas highlight how infusing variability and specificity of practice at appropriate timepoints, can support successful athletic performance and preparation by emphasising the all-round development through improving children's skill adaptation (Button *et al.,* 2020).

An Ecological Dynamics Rationale for Specificity and Generality of Practice

An extensive body of research informed by an ecological dynamics framework, over the past few decades, has evidenced the value of specificity and generality of learning experiences. Research investigating specificity of learning (conceptualised as *representative learning design*) has been conducted in a diverse range of sports contexts including cricket batting (Pinder *et al.,* 2011), springboard diving (Barris *et al.,* 2013), futsal (Travassos *et al.,* 2012) and ice climbing (Seifert *et al.,* 2015). Barris *et al.* (2013), for example, studied Olympic level springboard divers when they practised diving into a pool and in a dry-land facility which simulated the diving action (coaches used the latter because it enabled more repetitions of the preparatory phase prior to take off). Observations indicated different coordination tendencies under the two distinct task constraints, leading to performance differences at key stages of the dive (second approach step, hurdle step, hurdle jump height and board angles during the hurdle and at landing). These differences emerged during the preparation phase of dive take-offs completed in the dry land and aquatic training environments. For example, the elite divers showed significantly less board angle depression at landing (from the hurdle jump) during take-offs completed under the task constraints of the dry-land area than when diving into the pool.

These findings support the importance of representative learning design principles when using specificity of practice to advance skill levels and expertise in high performance sport organisations. In more specific practice experiences (i.e., learning to hit a backhand shot in tennis), a challenge is to ensure that learning designs represent contextual task (e.g., temporal, spatial, presence of opposition and competition) constraints which children can use as information to regulate their actions. By way of example in competitive sport, Browne *et al.* (2019) sampled 29,153 kicks from across different competition levels in Australian Rules Football to determine key task constraints on kicking skill performance. Analysis revealed that low kicking success was associated with physical pressure (37%), whereas high efficiency emerged when kicking to an open target (70%). Data of this nature can ensure specificity of practice experiences are more effective for

replicating competition environments and enhancing skilled behaviour. While getting access to this level of data to enrich children's learning experiences may be unrealistic for many children's coaches, implementing the concept of representative co-design can alleviate this challenge by drawing on children's knowledge of the environment, inviting them to consider how to change rules to produce practice conditions that feel more demanding and challenging when needed as in competition (for a detailed overview see Woods *et al.,* 2021).

Research has also demonstrated the precise value of generality of practice and play (captured in variable and unstructured play and activities) (see Phillips *et al.,* 2010, 2014; Lascu *et al.,* 2020; Cairney *et al.,* 2018; Machado *et al.* 2019). Indeed, the results of the study by Cairney *et al.* (2018) refute the idea of juxtaposing organised sports participation (structured specific practice) *versus* free play (unstructured and generalised play and practice experiences). Their evidence showed observations of a relationship between tendencies to participate in structured physical activity, closely allied with tendencies to engage in unstructured practice and play (termed 'free play' by the authors). This point was previously exemplified by Phillips *et al.* (2014), who interviewed 11 past or present Australian international elite fast bowlers who had taken more than 2,400 international test wickets in over 630 international test matches. This group were truly elite with all of them having taken at least 75 international test wickets and appearing in at least 20 international test matches. In terms of their early childhood experiences, unstructured practice activities were found to be important, with 73% of the expert bowlers saying that they did not specialize in fast bowling until the late teens. Several experts were not even involved in structured cricket until late in their teenage years. This factor questions the value of overemphasising specificity of practice in early specialisation programmes. Their data also confirmed that a particular advantage of late specialization for future fast bowlers in cricket was that it limits their exposure to injury associated with high bowling workloads during maturation.

Facilitating Skill Integration and Enrichment in Practice

A unified approach to general and specific training and practice challenges coaches of children and youth to understand how to integrate these dualistic positions to enhance developmental experiences (e.g., Bondarchuk's (2007). An ecological dynamics rationale explains how general preparation for performance advocated by Bondarchuk (1994, 2007), is relevant for the enrichment of athletic performance in every individual from early childhood onwards (Rudd *et al.,* 2021). Enrichment in practice supports the transfer of functional abilities and capacities, allowing a learner to use perception, action, and cognition during performance, as expertise in one sport increases (Chow *et al.,* 2020). As discussed later in this chapter, ecological-dynamics informed pedagogical frameworks (The Athletic Skills Model, Constraints-Based Coaching and Non-Linear Pedagogy) can support coaches and teachers to integrate a range of general and specific activities during practice to enhance the movement repertoire and athleticism of young athletes during development (Rudd *et al.,* 2020; Chow *et al.,* 2020; Woods *et al.,* 2020).

Learning through the process of enrichment aims to develop children's capacities (e.g., psychological, emotional, cognitive, perceptual, and physical) to interact meaningfully with environmental demands. This idea relates to an *individual environment fit* across diverse movement contexts (O'Sullivan *et al.,* 2020), where evolving capacities can support engagement in everyday movement tasks, skill adaptation in sport, and continued physical health across the life span. In developing this fit, children learn to perceive action opportunities (i.e., affordances) (Cordovil *et al.,* 2015; Gibson, 1979) to regulate their performance in different contexts. Through this process, functional movement solutions emerge when children develop the capacities to satisfy a range of specific and varying task and environmental constraints to achieve intended task goals (Sigmundsson *et al.,* 2021). Over time, it is crucial that children develop the capacities to perceive and distinguish between the multitude of affordances available in the environment that invite or repel actions (Adolph and Hoch, 2019). Play and practice experiences in childhood need to help learners to

navigate a rich landscape of action possibilities across sport and physical activity settings (Cordovil *et al.,* 2015).

Pedagogical Frameworks to Integrate Generality and Specificity Practice Designs

While theoretical and conceptual arguments for generality and specificity of practice are well advanced (e.g., Rudd *et al.,* 2020; Chow *et al.,* 2022), pedagogical guidance is needed to navigate the nuances associated with integrating these juxtaposed positions in learning designs. Non-linear Pedagogy and the ASM are contemporary models of pedagogical practice, informed by ecological dynamics, and provide a start point for practitioners interested in integrating generality and specificity of practice in sports training. The ASM supports enrichment of functional movement skills through learning, movement, perception, physiological, and competence transfer in generalised practice and learning experiences (for a detailed overview see Wormhoudt *et al.* 2018). The ASM advocates that children take part in multisports (i.e., playing and sampling many sports for fun) and donor sports (i.e., playing in sports that can enhance relevant skills for a chosen target sport), to encourage holistic movement competencies pre-, during, and post- engagement with specialised pathways. Engagement in these varied activities is based on specific phases of development and in the ASM biological age, and not chronological age, influences what stage a child should be experiencing at a specific time point. Passing through these stages of development aims to enrich children's capacities so they can cope with specialised training programmes when excelling in a target sport.

Aligned with the ASM, NLP provides specific theoretical design principles to facilitate learning at the microstructure of practice (for a detailed overview see Chow *et al.,* 2022; Correia *et al.,* 2019). To exemplify how NLP can support sport practitioners to integrate generality and specificity of practice designs, the principle of exploratory learning in representative learning design is highlighted. In general practice experiences, coaches can facilitate exploratory learning to support children in developing a functional range of individualised movement solutions to different problems posed in environmental settings (i.e., exploring multiple ways to beat a defender in a 1 v 1 situation).

Hacques *et al.* (2020) have suggested that supporting exploratory behaviours through carefully designed practice, and the facilitation of a child's search for specifying information sources, contributes to highly skilled coupling of perception and action. This coupling process helps to develop a functional fit between a child's action capabilities and the relevant properties of the environment.

When a coach is upskilled to deliver contemporary pedagogies, they are faced with the challenge of knowing when generality or specificity of practice is relevant and important at different times to enrich children's development experiences. Individualising the learning process is central to the ASM and NLP, with the ASM philosophy stating *first the child, then the athlete, then the specialist*. A nuanced balance between specificity and generality of practice is, therefore, a question of timing, based on the development status of a child at a specific timepoint, and not dependent on an age-based model of performance. To manage the challenges of identifying and supporting multiple individual differences at the same time, Button *et al.* (2020) have suggested several strategies to support coaches in this process. Aligned to concepts within the ASM and NLP, these principles relate to a learner-centred approach where a 'one size fits all' philosophy is rejected in favour of individual challenge (e.g., equipment changes or varied task challenges), facilitating exploration and adaptation to constraints. Through this approach, coaches can become more attuned to individual differences in development status, with a greater focus on performer (e.g., needs, prior experience or motivation), task (e.g., design features like information and intentions), and environmental (e.g., social support or economic status) constraints specific to each child. Next, we provide practical examples to support coaches and teachers to implement the concepts discussed this far.

Implications for children's sport coaching

Learning to move: Practical examples for sport practitioners

A high proportion of children do not have sufficient opportunities to play outdoors, unlike previous generations who had freedom to play games in the street, roam around their neighbourhoods and explore local fields and woodlands (Bates *et al.,* 2020). Considering this change in play opportunities, it is hardly surprising that many children possess a foundational movement skills repertoire that is more limited than that of their parents, and grandparents at the same age (Bardid *et al.,* 2015). One of the key reasons for the ASM's success is that children are provided with rich opportunities to interact and explore a multitude of varied movement environments. In the ASM, learning environments are devised as *skills gardens* where learners are encouraged to innovate and adapt actions through interacting with task designs which challenge them to explore and learn. The coaches working with children using the ASM model are continually traversing across a spectrum of generality to specificity in their learning and development settings.

To support coaches and teachers to adopt and make sense of their own practice and delivery we provide an example nonlinear pedagogy lesson plan created as part of the SAMPLE-PE project (see Figure 1.0 in Rudd *et al.,* 2020). The first thing to notice is that the session plan does not follow a traditional linear format that lists a set of tasks that should be completed in a set amount of time i.e., 10min warm up, 30 minute conditioned/small-sided game, and lastly 20 minutes of game play. Instead, a cyclical session plan is presented in which a coach would have developed three of these activity plans. Each activity plan works towards the same session objective. The three activities are not progressions from one to another, but rather they create different learning environments that will lead to the emergence of similar skills but under a variety of constraints. This adaptive approach means that there is no pressure for a coach to progress beyond one activity plan if learning is progressing in the current task. Instead, they can move on when the activity naturally runs its course, or the coach or learners have run out of ideas on how to perturb movement behaviours. For each activity plan five pedagogical principles informed by an ecological dynamics framework are utilised. These are representative learning design, movement perception coupling, outward facing attention, constraints manipulation, and functional variability.

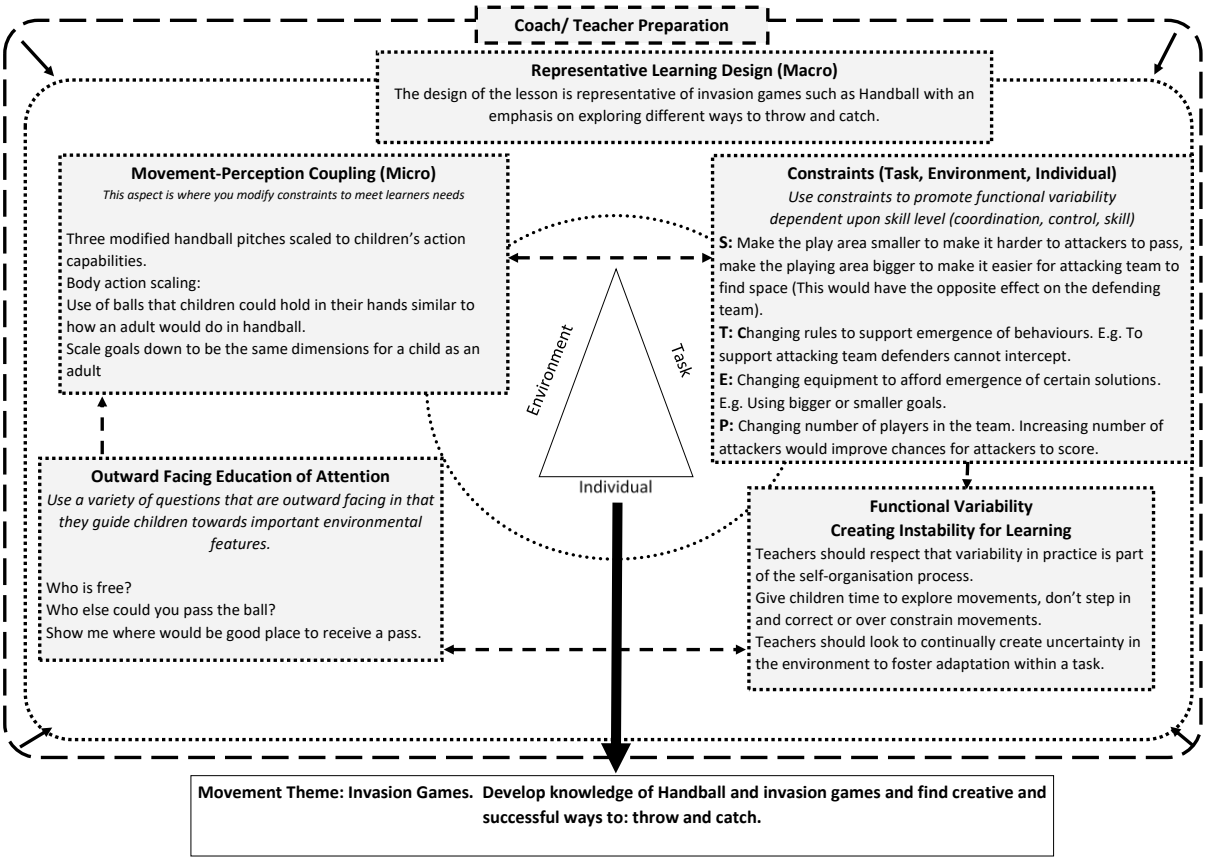

Figure 1: Example activity/ learning environment plan this one is for a games lesson for young children

To help coaches and teachers understand the planning process, examples of how the key pedagogical principles can be used to plan sessions are presented.

(1) *Representative learning design* emphasises the importance of skill transfer between practice environment and performance environment. Informational constraints sampled from competition (i.e., opponents, ground surfaces, time of day) are carefully designed into practice tasks to support learning transfer.

Example: In the NLP activity plan the coach is creating a handball game to improve young children's catching and throwing skills. The coach will introduce some general constraints, such as you cannot run with the ball and must throw the ball to pass and to score. This approach creates a

representative environment for sports like handball, but also for a variety of functional throwing and catching opportunities to emerge.

(2) *Movement-perception coupling* must be maintained when performing skills. This means that skills are practised in their entirety, rather than broken down into component parts or in a decontextualized fashion.

Example: In the NLP activity plan the coach builds and develops a more learner-centred activity plan, thereby starting to manipulate the environment to meet the children's action capabilities and body scaling constraints, for example scaling the dimensions of the playing space, ball, and goal targets.

(3) *An outward facing education of attention* allows for self-organization of movement patterns to meet the goal of the task and develops knowledge of the environment.

Example: In the NLP activity plan a coach pre-plans a variety of questions that are outward facing to guide children towards important environmental features that will help them attune to more functional movements within their environment. A coach may show a child where to look, but does not tell them what to see, using verbal information to guide interactive search activities in play, such as: "Which of your teammates is free, where can you throw the ball in the goal to beat the keeper… don't tell me show me".

(4) The manipulation of constraints – careful manipulation of task constraints will lead to self-organisation and the emergence of new functional movement patterns.

Example: Coaches can take a simple S.T.E.P (space, task, equipment, people) approach to create nonlinear changes to movement behaviour. Increasing or decreasing the space will lead to greater, or less pressure, on the attack or defence. Manipulating the task (i.e., implementing a rule that a child cannot hold the ball for longer than three seconds) is likely to increase scanning behaviours prior to catching the ball. Changing the equipment size of goals will lead to varying degrees of success in scoring. Manipulating the number of people playing, creating uneven teams, changing

teammates and opponents will create different dynamics and lead to nonlinear changes in performance behaviours.

(5) *Infusing perturbations within the learning process.* This means that we see variability as exploration of movement possibilities, and not as error in the system as would be the case with traditional theories of motor learning and pedagogies.

Example: This is fundamental to skill adaptation and is important for a coach to understand as this is how we observe learning in action. Children's movements skills may transition from one stable state to another. Once movement skills are in a stable state, little to no learning will take place. The coach, therefore, needs to perturb the current movement pattern to create innovation in the child-environment system. A skilled coach uses a combination of education of attention and constraint manipulation to achieve this outcome for learning to occur and progress.

Summary, Future Directions and Future Research

This chapter has discussed the importance of generality and specificity of practice experiences that are traditionally viewed as a dualism. Contemporary motor learning theory, in the form of ecological dynamics recommends a nuanced balance between these practice contexts can provide more integrated motor learning experiences to enrich children's skills repertoire. Based on this conceptualisation, contemporary pedagogical models, such as NLP and ASM, can support coaches to implement individualised learning approaches, where a balance of generality and specificity of practice can support the development of each child at specific timepoints. Identifying and supporting individual differences is essential to support children's enriched functionality throughout their development. This approach can go some way to avoiding the defects of an early specialisation approach and build a platform for children to thrive in specialised performance environments later in their development.

While there are applied examples of contemporary pedagogical models in practice (e.g., Roberts *et al.,* 2019), future research studies should aim to document sport coaches' and

practitioners' lived experiences of transitioning between generality and specificity of practice in learning programmes. Studies of this nature can provide important insights into the complex relationship between the practices that coaches design and the psychological, physical, and emotional dimensions that influence children's capacity to adapt to new challenges in practice and competition.

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