# Specialist role coaching and skill training periodisation: A football goalkeeping case study

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# A Football Goalkeeping Case Study

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**Abstract**

In association football, professional teams are increasingly devoting resources to the role-based development of individual athletes and sub-groups. By employing 'specialist coaches' into athlete-support structures, clubs aim to facilitate individualised athlete training programs to enhance performance preparation, as well as skill learning and talent development. Considering the trend for 'specialist coaching' within high performance sports organisations, it is important to investigate how contemporary pedagogical training approaches can enhance the effectiveness of these training programs to facilitate performance functionality. In order to explore ways of applying contemporary skill training theory to 'specialist coaching', the case study for specialist role-based coaching is exemplified by the context of football goalkeeper training on a professional level (i.e., including training documentation, analysis and practical examples). Integrating key concepts from the theoretical perspective of ecological dynamics, allied to principles of nonlinear pedagogy and the constraints-led approach common skill training principles for specialist role coaches are highlighted. . They illustrate the use of the recently-introduced 'Periodization of Skill Training' framework (i.e., termed the 'PoST' framework) for specialist role coaching, exemplifying a way to harness opportunities for performance enhancement and individualised talent development in the football goalkeeping context.

**Key words:** association football; talent development; ecological dynamics; nonlinear pedagogy;; role-based coaching, 'periodization of skill training' framework

**[word count: 4991]**

## Specialist Coaching and Skill Training Periodisation:

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## 1. Introduction

Contemporary professional sports organisations are constantly seeking to gain a competitive advantage, often by employing specialised coaching and sport science staff into the athlete-support structures. In the past, there was a tendency to include all athletes within generalised, whole group training at a developmental level and in preparation for performance. The implementation of a whole group methodology in practice provided a sort of 'averaging' approach, failing to place the individual athlete at the centre of the training process. In modern sports, like Association Football (termed football in this article), different specific needs of players with specialised roles are exemplified by set piece and penalty practice for specific players, defensive coordination and cohesion for defenders and goal-keeping training for guardians of the net. Currently, there is a greater emphasis on break away sub-groups for specialised training that caters for individual needs. In football, there is an emerging trend to use 'individual development coaches', who focus on the role-based development of individual athletes and sub-groups (e.g., attacking, defence, goalkeeping (GK) and 'movement rehabilitation' coaches to work with athletes recovering from injuries). Employment of specialised role coaches provides individual performers with the opportunity for additional specialised training outside whole-team practice sessions [1]. In their work, these 'specialist coaches' usually train with small groups of players with specialised performance roles (e.g., between one and four athletes), seeking to address each athlete's role-specific strengths and weaknesses. While the use of 'specialist coaches' is a welcome advance that provides several opportunities and challenges (addressed below), there are currently no models to guide practice design, based on theoretical concepts and pedagogical principles. It is important to explore how such a model may guide contemporary pedagogical training approaches to enhance the effectiveness of 'individual development coaches', in

order to facilitate performance preparation, as well as skill learning and talent development. Such a model would be informed by contemporary skill acquisition theory and pedagogical principles.

For the specialist coaching context of football GK training, it is traditionally advocated that "the repetition of relevant skills […] is the only way to consistently improve" [2, p.178]. While there is clearly a need for high practice volume for skill expertise acquisition in high performance sport [3, 4], it has become apparent that coaches and sport scientists need to assess the *quality* of specialised practice designs that are used in training to avoid documented problems of ineffective use of time and accumulated psychological, emotional and physical effects of unnecessarily high training loads and repetitions [5, 6]. Rather, in high performance sports organisations, there is a need for developing a model of practice capturing key characteristics of representative design, as well as conditions that require high variability and adaptability that athletes with specialised roles may face in performance [7].

Motivated by recognised issues with long-standing 'traditional', prescriptive, decontextualized and over-repetitive (GK) skill training approaches (e.g., [9, 10]), the case study presented in this paper describes the challenges faced in applying key concepts from contemporary skill (acquisition) training theories to GK training within an U23s team at a German professional football club (i.e., a unique football context, wherein players and GKs transition from youth to professional men's football). Particularly, this case study and the pedagogical approach to GK skill training highlight the emerging context of 'specialist coaching' and integration of key concepts from the theoretical perspective of ecological dynamics, which is allied to principles of nonlinear pedagogy and the constraints-led approach (CLA). Additionally, the recently introduced 'Periodization of Skill Training'

framework (i.e., termed the 'PoST' framework[1]), will further support the need for such specialised role based Models of Practice within sport organisations.

## 2. A model of practice based on contemporary skill acquisition theory for specialist role coaches.

With the trend for increased numbers of 'specialist coaches' within high performance sports organisations, a model of practice for their work needs to be driven by understanding of opportunities and challenges that drive this specialised role-coaching context. Here we discuss a model of practice predicated on some of the key concepts of a Nonlinear Pedagogy (NLP) using a Constraints-Led Approach to facilitate skill acquisition and performance preparation in athletes with specialised roles in sports teams. This initial analysis sets up the goal keeping practice case study from professional football, presented later.

A major aspect of the model concerns the individualisation of training designs which can be tailored towards each individual athlete's needs (underpinning psychological, emotional, social and physical interactions with a performance environment), making this coaching context unique. Placing the individual athlete at the centre of the training process has been a 'mantra' in some pedagogical approaches, but there has been few attempts to theoretically rationalise this model principle, which is core to an ecological dynamics rationale (Woods et al., 2020). What does individualisation of practice designs imply? In ecological dynamics, individualisation of practice designs implies that the constraints on each athlete are taken into account in specified tasks which place the athlete at the centre of the training process (Davids, 2015). In response to each athlete's intrinsic dynamics (roughly, the personal behavioural and performance characteristics that each performer brings to a learning environment), the perceived task complexity of training exercises can be manipulated by

96 'specialist coaches' to adjust training designs based on an athlete's strengths and weaknesses
97 with respect to a specific role (see [1]). While communication, instruction and feedback
98 between single athletes and coaches can be highly individualised, practitioners have the
99 opportunity to further develop learning environments that focus on the specification of skill
100 adaptation for each individual (e.g., by focussing on within-skill variability or between-skill
101 variability of goal-directed, movement patterns; see [11]).
102 In terms of driving an individualised approach to practice design, 'specialist coaches' face
103 various challenges that (in comparison to team coaches) may constrain their coaching work.
104 For example, 'specialist coaches' in team sports are faced with the challenge of replicating
105 practice designs that are representative of performance environments (e.g., in 11vs.11
106 football). Mainly due to the limited number of athletes involved in specialist training sessions
107 (e.g., often between one and four), simulating complex and representative system interactions
108 presents a constraint. Furthermore, time constraints may pose a challenge for 'specialist
109 coaches' (i.e., a 'specialist coach' may only get to train with the specific athlete(s) for short
110 periods of time or in irregular intervals). Traditional pedagogical approaches may focus on
111 repetition of movements to replicate a putative 'common optimal template' in practice
112 (Renshaw et al., 2019), which makes it easier to practice with small group numbers (n=1 to 4)
113 focusing on endless repetitions to 'groove' a skill. However, to achieve specialised role
114 coaching in a Nonlinear Pedagogy, the model of practice should be based on the credo of
115 'repetition without repetition' advocated to enhance *dexterity* in learners by Nikolai Bernstein
116 [8, p.134]. The core model principle of 'repetition without repetition' aligns well with
117 concept of individualised designs in the practice model proposed here to capture how
118 specified adaptations and variations of training needs can be continuously incorporated into
119 training designs over longer timescales as a function of learning and experience.

An integrative model of practice conceptualised in this case study analysis proposes that 'role specialist coaches', sport science support staff, team coaches and medics inside the organisational structure should be theoretically-driven by a unifying conceptual framework to collaboratively discuss, design, coordinate and facilitate individualised athlete training programs to enrich performance functionality [12]. In turn, these programs will inhibit the adoption of isolated approaches with potential for conflicting athlete development practices. The implementation of a model of practice should provide an integrated platform for specialist role coaches to collaborate as part of a large group of practitioners, while maintaining a specific developmental focus on individual athletes or sub-groups [12, 13]. For example, training sessions and athlete contact time for 'specialist coaches' need to be carefully coordinated between team coaches and specialists, leading to individualised training designs becoming enriched to effectively complement team-based training sessions.

Due to various constraints on the practice of 'specialist coaches', it becomes paramount for these practitioners to use a coherent model of practice, underpinned by a unified conceptual framework and constant communication with the head coach and other specialists within the coaching staff (e.g., rehabilitation coaches, athletic trainers, psychologists, physiotherapists, performance analysts).

### 2.2. Ecological Dynamics: A framework for specialised-role coaching in team sports.

The contention here is that ecological dynamics is a theoretical framework that advocates concepts and principles that are most useful for specialist-role coaching to support individual athletes in sports teams to effectively self-regulate under the constraints of competitive performance environments [15, 16]. In ecological dynamics, *self-regulation* is conceptualised by athletes' emergent interactions and co-adaptations with the dynamics of the environment (e.g., changing conditions and contexts of performance shaping interactions

of cooperating and competing defenders and attackers in football; 17). To support these dynamic performer-environment interactions, and for athletes' behaviours in competition to be functional, practice designs emphasising the intertwined relationship between *perception*, *action*, *emotion* and *cognition* is paramount [16, 18, 19]. This theoretical idea implies principles of sports coaching, imbued in a coaching team's responsibility to design training environments and tasks rich in variability and representative of competitive performance demands [20-22]. Through adequate training designs that holistically integrate the requisite four performance-regulating sub-systems (i.e., perception, action, emotion and cognition), coaches can provide a fruitful platform for specialised role athletes to self-organise, harnessing and exploiting system dynamics [23]. A key aim of specialised role coaching is to support the self-organisation tendencies that athletes and teams can use to self-regulate their performance behaviours, fitting their functional performance behaviours into a very broad (overarching) game model imposed by a team's head coach. Specialised role coaching can provide athletes (and therefore teams) with the flexibility needed to functionally exploit, adjust and adapt to the dynamic constraints of competitive performance environments in order to specifically contribute to team goals [14]. Sports team coaches often over-emphasise a *global-to-local* direction of self-organisation tendencies (imposed on the team top-down), but the context of 'specialist coaching' warrants more in-depth exploration of self-regulation from *a local-to-global* direction (see [23], for an analysis of bi-directional self-organisation tendencies). The former global-to-local directions describe "global collective system behaviours [… for] functional integration of individuals" [25, p. 634]. In team sports, coaches traditionally aim to impose these global synergies between players in a team through rigid plans and default strategies, emphasising holistic, structured training designs, game plans, shadow play (e.g., 11vs.3) and rehearsal of pre-organised moves [14, 23]. The extremely important and underused local-to-global direction presents individual players with

opportunities to ongoingly adapt their specific contributions in the form of interactions with local performance constraints by manipulating challenges and problems faced by each individual, within the context of a specific role, regularly in training. In this way specialised role coaches can develop game-intelligent, creative and adaptable performance solutions. Adopting this approach with specialised role athletes, coaches should avoid immediately providing athletes with solutions to performance challenges presented by conditions, events and opponents. It can be beneficial for practitioners to consequently oversee the design of practice tasks which encourage the exploration of varied performance solutions in training [23].

An important challenge for sports coaches is to assess possible ways of driving and manipulating athletes' self-organisation tendencies within training environments (Woods et al., 2020). In this respect, principles of nonlinear pedagogy (NLP) and the constraints-led approach (CLA) can play an important role in supporting specialised role support practitioners with their training planning, as we discuss next.

### 2.3. Principles of Nonlinear Pedagogy for specialist role coaching.

In support of these notions, various pedagogical principles can be derived from the theory of ecological dynamics to drive specialised role coaching for individualised athlete development (see [27], for an in-depth elaboration of various principles). The key principles of NLP that underpin a model of practice for specialised role coaches are outlined below, and later in this paper, a case study on football GK training will highlight some implications for how they can be used with sub-groups of performers with specialised roles in sports teams:

1) the continuous *coupling of information and movements* (i.e., the cyclic and reciprocal coupling of directly perceived key environmental information with the coordination and control of movements [15, 21]). This principle of NLP signifies that actions should not be practised in isolation of

contextual information. Practice tasks need to contain specific sources of information that are used to regulate behaviours in competitive performance environments;

*representative learning tasks* (i.e., training tasks that sample contextual information sources found in competition and that consequently stimulate similar perceptual-cognitive and motor responses; [28]). Information in practice designs should carefully simulate the information present in performance environments. For example, this principle signifies that specialised role coaches in football should avoid arbitrary conditions in practice settings. They should maintain the representativeness of the dimensions of a practice environment, and spatial locations of nearest attackers and defenders, as well as their dynamic movements, should be maintained in practices;

3) a rather *facilitating coaching style* (i.e., the coach's use of a *hands-off* coaching approach that guides athletes' exploratory processes; Renshaw et al., 2016). This type of coaching style for athletes would avoid the detriment of too much technical repetition in practice and would place them at the centre of the learning process. This type of coaching style would allow them the safety to discover and explore performance solutions in uncertain situations, rather than immediately interjecting with verbal instructions and corrective feedback to provide certainty during practice: a luxury which they may not experience often in competitive performance.

4) *functional (movement) variability can support performance* (i.e., it is a functional property that helps skilled athletes to adapt movement behaviours towards changing constraints within the performance environment. Related to

point 3 above, for specialised role coaches, there should be a pedagogical approach which supports the inclusion of problems, challenges and choices for athletes in practice designs; [29]).

4)

Overall, the theoretical ideas discussed here support the aim of developing athlete-environment-centred training designs in sport. The suggestion is that coaches could apply key principles of NLP to underpin the CLA as a coaching methodology for specialised athlete training.

### 2.3. CLA as the methodology used by specialist coaches.

The CLA, which is grounded on Newell's model [30, 31], focuses on the constant interaction of three constraints categories within any performance environment: 1) the *individual* (e.g., including the athlete's perceptual-cognitive, technical or further physiological abilities); 2) the *environment* (e.g., weather and temperature, light conditions, or game score; social evaluation by an audience); and 3) the *tasks* (e.g., specific training tasks, rules and instructions, equipment and technology used in practice; [17, 21]).

Principles of ecological dynamics in NLP and the CLA represent a viable pedagogical methodology to be used by (specialist) coaches to design training tasks that promote self-regulation that needs support the performance of individual athletes (e.g., GKs), sub-groups (e.g., a defensive or attacking unit) and the whole team in competition. When coaching players with a specialised role in sports teams, e.g., goalkeepers, set piece specialists, coaches should constantly apply task constraint manipulations in training [20, 22]. By posing game-representative problems and challenges, these athletes are challenged to adapt their movement solutions, choices, decisions and intentions [32]. Under varying constraints, athletes with specialised roles can learn to repeatedly detect and use opportunities for actions

(i.e., affordances), attune to critical environmental information sources, and learn to form flexible, but stable, perception-action couplings [15, 33].

### 2.4. Skill adaptability training based on the 'PoST' framework.

Merging aforementioned skill training theory, the 'Periodization of Skill Training' framework (i.e., 'PoST' framework) presents a training framework for specialist role coaches in any team sport to plan and design training sessions for individuals and sub-groups (see [1]). By applying the 'PoST' framework and its three training stages of 'Coordination Training', 'Skill Adaptability Training' and 'Performance Training' (see Figure 1), specialist role coaches can periodise skill training over the timescales of both macro and micro cycles (i.e., over the course of several months and over the course of an entire week, respectively). In the 'PoST' framework, any training design is evaluated using two main components: 1) its level of 'game-representativeness' (i.e., the extent to which training tasks represent actual performance demands faced by athletes in competition); and 2), its level of 'task challenge complexity' (as subjectively perceived by individual athletes). Here, we discuss how both properties for training tasks in the 'PoST' framework provide valuable guidance for specialist role coaches to adopt an individualised approach and assess each athlete's skill development and training stages.

[Insert Figure 1]

Three skill training stages, based on Newell's [30] model of motor learning, are displayed in the 'PoST' framework (Figure 1). First, training designs within the stage of *'Coordination Training'* are focused on "searching for and exploring coordination movements within the emerging training environment" [1, p. 6]. While training designs may be rather low in both game-representativeness and task complexity (i.e., aiming at movement

stability), it is the coaching approaches, such as the use of task simplification and guided discovery, that drive this initial skill training stage [34]. Second, the stage of *'Skill Adaptability Training'* has the aim of "enhancing the adaptability, functionality, and robustness of motor skills under perturbation of dynamic environments" [p. 7]. By using three distinct training sub-stages (i.e., *'Movement Variability Training'*; *'Complex Training'*; and *'Team-based Training'*), levels of game-representativeness and task complexity can be increased in layers. Particularly, the choice of training sub-stage may be determined by factors such as the athlete's skill level, the number of athletes involved in the specialist role training session, or the amount of training time available. Eventually, it is (long-term) skill learning and the adaptability of movement solutions under rather destabilised training conditions that are the focus of this training stage. Third, the 'Performance Training' stage aims to "enhance the energy efficiency and adaptability of movements in perturbing and complex environments" [p. 10]. Particularly, it is the optimisation of team performances in preparation for impending competition that significantly impacts training approaches in this stage. For example: team-tactical 11vs.11 football games in preparation for an immediate opponent, based on data from performance analytics of specific opponents, or pre-game warm-up routines focussing on performance stability are part of this final training stage (e.g., see [35], for an application of the framework to evaluate professional football GKs' game warm-ups).

Finally, in order to further support specialist role coaches in their understanding of the 'PoST' framework for training designs (i.e., the quality and quantity of training environments), Figure 2 presents a model of various focus areas for different skill training stages.

[Insert Figure 2]

294

295 Based on the x-axis (i.e., showing a qualitative training scale from low to high levels
296 of game-representativeness) and the y-axis (i.e., displaying environments with low to high
297 numbers of training repetitions), the model in Figure 2 presents four quadrants:

298 1) Training in the top left quadrant is considered to be rather low in game-
299 representativeness and high in repetition numbers. Athletes here would experience
300 stable training conditions based on the stages of 'Coordination Training' and
301 'Performance Training'. While the former stage, for example, could focus on stability
302 of movement coordination and controlled training environments for rehabilitation
303 training following an injury, the latter stage could present GK training with a physical
304 or athletic development training focus (i.e., as opposed to a skill learning focus).
305 2) The bottom left quadrant presents training designs rather low in game-
306 representativeness and low in repetition numbers. Particularly, a 'Performance
307 Training' focus in sessions, such as the training routine the day prior to game day or
308 the warm-up preceding a game, play major roles in this section. With the aim of
309 optimising and stabilising performance, psychological drivers such as 'confidence'
310 are a main training focus (e.g., [35]).
311 3) The quadrant on the top right shows training designs rather high in game-
312 representativeness and high in repetition numbers. Especially, in this section, there is
313 a focus on skill learning and movement adaptability by applying critical principles
314 and training sub-stages of 'Skill Adaptability Training' (i.e., 'Movement Variability'
315 Training, 'Complex Training', and 'Team-based training'; see [1] for examples).
316 4) Training in the bottom right quadrant presents a focus on higher levels of game-
317 representativeness and low repetition numbers. For GKs, particularly larger football
318 games within training environments are covered by this quadrant (e.g., an 11-versus-

11 football game). These larger games may either have a focus on skill learning (i.e., part of the 'Skill Adaptability Training' stage) or a focus on team-tactical and performance optimisation (i.e., part of 'Performance Training).

In summary, the application of the 'PoST' framework, predicated on an ecological dynamics rationale and principles of NLP and methodologies of the CLA, may be beneficial for any specialist role coach, independent of the whole team training context. The case study presented in the following section will draw on the 'PoST' framework (including its theoretical groundwork), applying it to the context of football GK training at the senior professional level.

## 3. Case study - Football GK training in professional football (2018/2019 season)

For the professional football GK case study, training examples are drawn from the 2018/19 season of the U23s team at a German Bundesliga club (i.e., currently playing in Germany's fourth highest men's league). The club is considered to run one of Germany's top youth football development programs with an academy that is certified as an 'elite school of football' with the maximum three-star academy rating from the German Football Association [36]. Furthermore, the men's first team has formed part of the German Bundesliga since 2008 and, in recent years, it has qualified for top-level European club competitions, such as the UEFA Champions League and Europa League [37].

The case example examines GK-specific training of three young professional GKs between 18 and 23 years ($M$= 20.33 years, $SD$= 2.31) in the 2018/19 season. Each GK has multiple years of playing experience at the top-youth level (e.g., German U19s Youth Bundesliga), in addition to some experience in senior professional football (e.g., Bundesliga 3 and Regionalliga). Notably, the U23s age group in Germany displays a unique transition period, wherein players and GKs move from youth to professional senior men's football.

Consequently, finding an adequate balance between training with a focus on performance preparation (prior to competitive league games) and development training to enhance skill learning and refinement (for a future professional football career) presents a major challenge for specialist GK coaches.

In order to further illustrate the use of the 'PoST' framework and its theoretical underpinnings for skill training periodisation and planning in the given context, the following sections will discuss: 1) skill training documentation and analysis of the 2018/19 season; and 2) practical football GK training examples. Notably, for this case study, the focus is on GK-specific training carried out by specialist GK coaches (i.e., coaches with expert knowledge on GK skills and techniques; [38]).

### 3.2. Skill training documentation and analysis.

Throughout the 2018/19 season, all training documentation and session designing (see later) was assisted by a specialised GK training software provided by *Goalkeeping Development GmbH* [39]. According to the recorded data for the entire season, all three GKs in the U23s squad each accumulated a total training time between a minimum of 230.8 hours (13.848 minutes) and a maximum of 399.93 hours (23.996 minutes); these training hours included GK-specific technical-tactical, athletic, mental and team-based training sessions on and off the football pitch. In regard to GK-specific training (as designed by 'specialist GK coaches', including an author of this paper), the GKs completed between 143 and 243 on-pitch training sessions, totalling 94.63 hours (5678 minutes), 106.22 hours (6373 minutes) and 160.18 hours (9611 minutes) of training respectively for each GK. These training numbers average at between 177 and 224 minutes of weekly GK-specific training time for each athlete. Notably, each GK's total number of training sessions was determined by various factors, such as injury breaks, the game schedule and additional training sessions with the First Team.

Within the U23s context, a total of 204 training days, 34 competitive league games (in Germany's 4th division) and 11 test matches was recorded and integrated into the long-term skill training periodisation approach. In particular, there are two types of training analyses considered for this case study: 1) the periodisation of skill training on the macro and micro levels, as driven by the use of the 'PoST' framework (Figures 3 and 4; [1]); and 2) the analysis of training session time spent on five GK-specific technical-tactical core areas (i.e., 'Basic Techniques', 'Distribution', '1-versus-1 Techniques', 'Push-off Diving' and 'Crosses & Sweeping'; see [35] and [40] for detailed descriptions).

***3.2.1. The periodisation of skill training on the macro and micro levels.***

Skill training periodisation of all GK training sessions is presented by Figures 3 and 4. Figure 3 illustrates a pre-planned GK training calendar for the entire season (i.e., planned by the 'specialist coach' in advance for the course of 10 months). While the focus for each training session – be it 'Coordination Training' (highlighted in blue), 'Skill Adaptability Training' (green); or 'Performance Training' (crimson) – is clearly marked in the figure, further events, off-days (for recovery), and winter/summer breaks are noted (i.e., see the legend on the right in Figure 3).

[Insert Figure 3]

Generally, by pre-planning training months in advance, specialist (GK) coaches are able to get an overview of future training sessions: they are able to identify which particular periods will focus solely on skill learning (i.e., presented in green in the calendar) and which periods are to be dedicated to performance stability (i.e., displayed by crimson coloured training days). For the U23s case study, a total of 204 training days throughout the season show the following distribution towards training time spent on each of the three 'PoST'

framework training stages: 55.39 % (i.e., 113 sessions) focused on 'Skill Adaptability Training'; 43.63 % (i.e., 89 sessions) focused on 'Performance Training'; and 0.98 % (i.e., 2 sessions) focused on 'Coordination Training'. Notably, the dominant focus on skill learning, over performance-preparation training throughout the seasonal training plan is driven by the coach's interpretation of the U23s football context; this includes the idea that professional U23s GKs are in a transition phase between development and high-performance football. While having to be acquainted with performance pressure encountered in top-level men's professional football, GKs in the U23s age group still needed to focus on (long-term) skill learning and refinement.

In regard to micro level planning of training, Figure 4 (below) demonstrates pre-scheduled training planning for an exemplary week within the season. Particularly, various information for each training session is documented: 1) the training stage, (i.e., linked to the 'PoST' framework and colour-coded in Figure 4); 2) the technical-tactical core areas; 3) the estimated levels of task complexity (i.e., low, medium or high) and game-representativeness (i.e., low, moderate or high); and 4) the content of the entire training session (including team-based training parts). With this weekly pre-planned training calendar in mind, specialist (GK) coaches gain a more detailed idea of structures and contents applied to each single training session. Based on this insight, single session designs, training tasks and exercises can be planned accordingly.

[Insert Figure 4]

### *3.2.2. Training analysis of GK-specific technical-tactical core areas.*

Since the GK position demands athletes to perform a vast range of complex handling and football skills [35], the documentation of five technical-tactical core areas (i.e., 'Basic

Techniques', 'Distribution', '1-versus-1', 'Push-off diving' and 'Crosses & Sweeping'; see [40]) appears to be important for GK-specific training planning. Along with the aforementioned periodisation of methodical coaching approaches to training, Figure 5 (below) presents the recorded average training time spent on technical-tactical components of goalkeeping.

[Insert Figure 5]

In detail, GK-specific training from the perspective of various technical-tactical core areas displays a major focus on the categories of 'Basic Techniques' (i.e., 38.83 % of training time) and 'Distribution' (i.e., 28.1 %) throughout the season. Despite the importance of all five areas, this outcome may be justified by the statistical relevance and predominant importance of these two categories for successful goalkeeping [40, 41]. Notably, when calculating each of the three GK's average training minutes spent on the core areas, the standard deviation values display rather large discrepancies; this finding may be explained by one GK having missed several months of training due to injury.

In sum, while the quantitative analysis of training planning is an important responsibility for 'specialist coaches', ensuring a high methodical quality of training designs remains critical. Consequently, and in reference to aforementioned skill training theory, the authors present practical GK training examples (see below).

### 3.4. Training Examples - football goalkeeper training.

Here, we provide two examples of how 'specialist GK coaches' could implement skill training principles into GK training exercises with a focus on 'Skill Adaptability Training'. Notably, for both presented figures, a graphics tool for specialised GK training designs was used (see [39]).

444 ***3.4.1. Training example 1.***

445 *3.4.1.1. Objective.*

446 The objective of the first training example is to improve the GKs' technical-tactical
447 1vs.1 behaviour in the form of a complex game. Limited to a number of four GKs (i.e., a
448 common constraint for GK-specific training), GK coaches could aim to holistically integrate
449 perceptual-cognitive and motor processes in regard to 1vs.1 situations on goal. In other
450 words, the training game example requires all GKs to constantly make technical-tactical
451 decisions, self-regulate and organise functional movement solutions, depending on changing
452 contexts. With the aim of scoring in the opponent team's goal, this exercise may take the
453 form of competitive GK training game.

454 *3.4.1.2. Training setting.*

455 The training setting is illustrated below in Figure 6. For this training example, coaches
456 would require two smaller-sized football goals and some cones to mark the playing area. At
457 its core, the game displays a 2vs.2 competition in which Team A (i.e., GK1 and GK2) would
458 receive the ball from the coach and could attack on Team B's goal (i.e., GK3 and GK4).
459 While GK1 would remain in the one half of the pitch, GK2 would move up to the opponent's
460 half and can receive passes to attack (Figure 6). While GK3 (for the defending team) would
461 defend the goal, GK4 can only move on and defend the line that is marked by the white cones
462 in Figure 6. Both GK3 and GK4 can use their hands to intercept the attacking team at any
463 time.

464

465 [Insert Figure 6]

466

467 ***3.4.2. Training example 2.***

468 *3.4.2.1. Objective.*

The objective of the second training example presents a complex GK exercise which includes four GKs. With the aim of posing various challenges of defending the goal from close distances, this dynamic exercise provides a high number of training repetitions. And in addition to encouraging the organisation of game-representative perceptual-cognitive and motor behaviours, the exercise allows a multitude of performance solutions that GKs can variably execute in order to defend the goal.

*3.4.2.2. Training setting.*

Starting with the coach having 5-6 balls lined up centrally in front of the goals, various shooting and scoring options are given for each repetition (see Figure 7 below). One option is for the coach to shoot directly at either of the two smaller-sized goals (i.e., GK4's goals; option 1a in Figure 7) or the regular-sized goal (i.e., GK3's goal; option 1b). Alternatively, the coach can pass the ball to GK1 or GK2 for a shot at the regular-sized goal (i.e., options 2a and 2b), or the coach can pass the ball into the space for GK1 or GK2 to attack GK3's goal (i.e., options 3a and 3b). All 5-6 balls are played one after another before GKs switch positions.

Importantly, for the set-up of this complex GK exercise, it is the coach's role to be in a position to shoot/pass the balls and thus, manipulate task constraints and challenges GKs are confronted with. In other words, the coach is controlling the training environment and may adapt it based on individual GK's needs.

[Insert Figure 7]

## 4. Concluding remarks

The aim of this case study was to illustrate how contemporary theoretical skill training principles could be implemented in an applied specialised role coaching context (i.e.,

494 football GK training). In detail, the case of 'specialist coaching' provides a unique context for
495 individualised athlete development that increasingly draws attention from both academics
496 and practitioners. While 'specialist coaching' has emerged in various team sports over the
497 past years, the optimal integration of these specialists into organisational structures may offer
498 substantial opportunities for improvement of the work of sports organisations. By proposing
499 the organisation of a Department of Methodology and the use of common skill training
500 principles (using a coherent theoretical framework of ecological dynamics, with principles of
501 NLP and CLA), we exemplified a way to circumvent possible intra-organisational tendencies
502 for isolated work and harness opportunities for performance enhancement and individualised
503 talent development. Furthermore, from a practitioner's perspective, the case study of GK
504 training at a professional football club suggests how 'individual development coaches' (in
505 any team sport) could review their own training (periodisation) practices and potentially
506 adopt a similar approach for individualised athlete development. Finally, as "one size does
507 not fit all in terms of practice activities" [32, p.19], the notion of placing the athlete at the
508 centre of the learning process provides a huge opportunity for enhancing the practice of any
509 'specialist coach' working with individual athletes.

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**Figures**

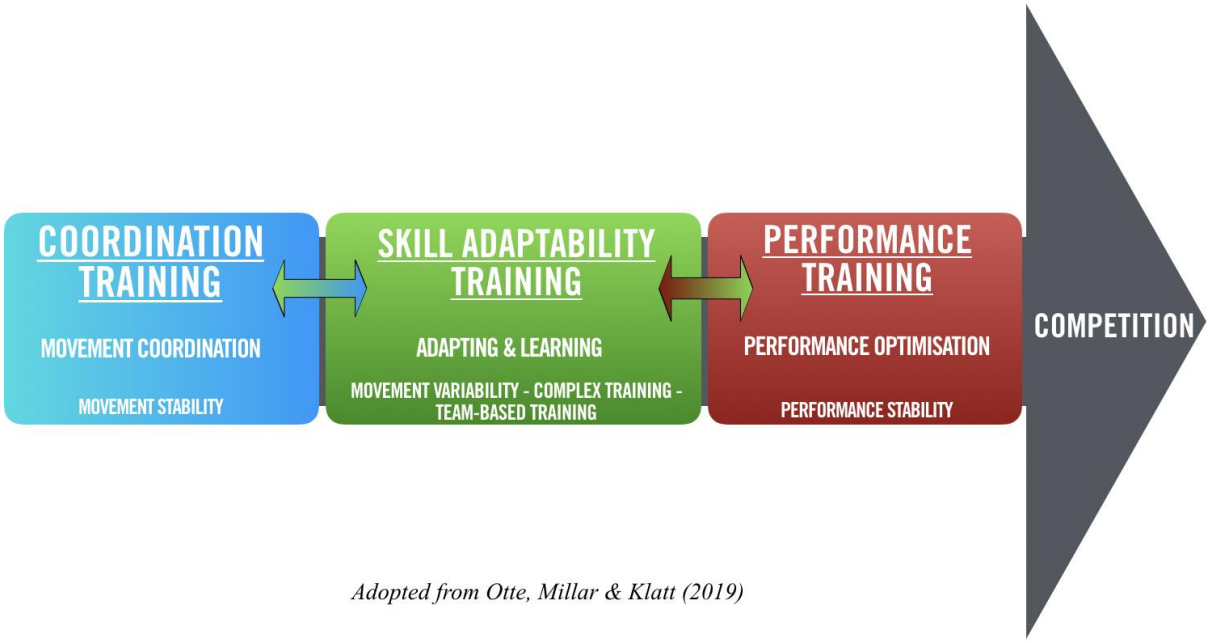
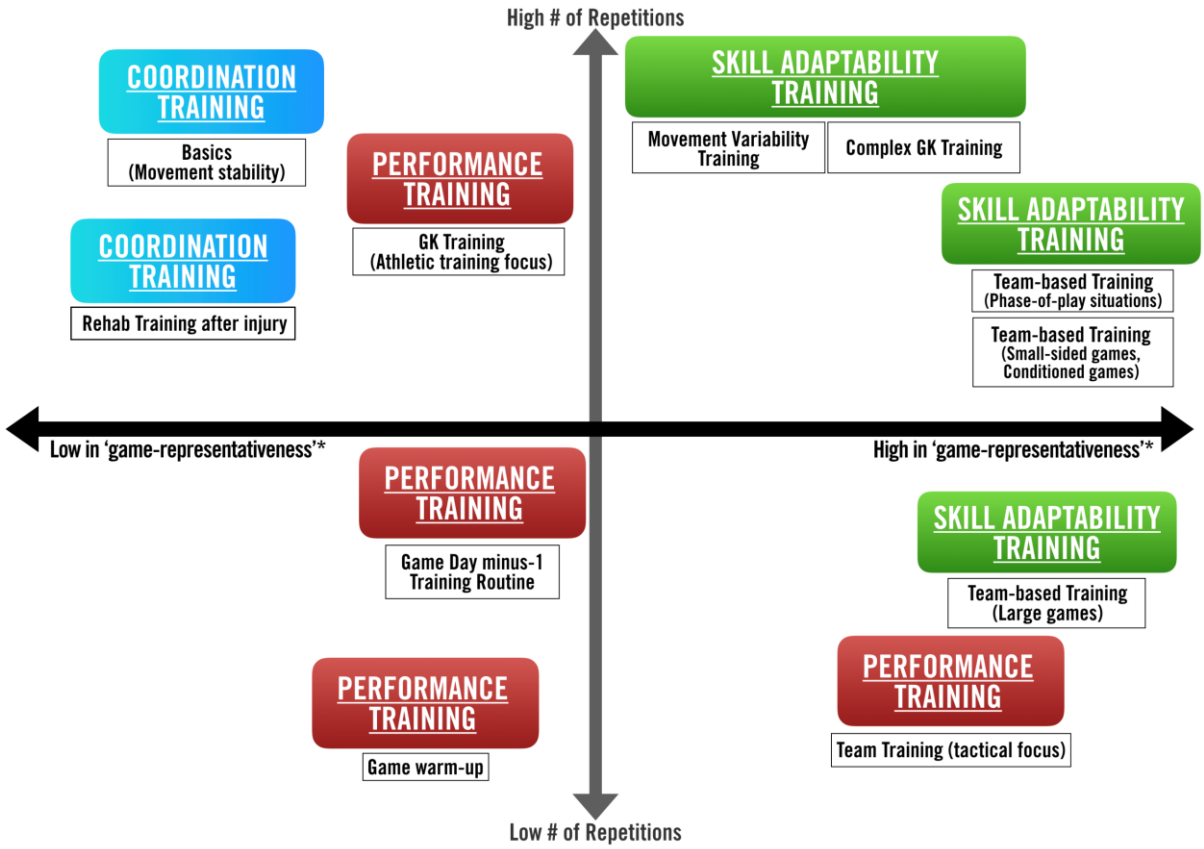



*Figure 1. Skill training stages based on the 'PoST' framework (adopted from [1])*




** Skill training stages and classifications partially adopted from 'PoST' framework (Otte, Millar & Klatt, 2019)*

*Figure 2: Focus areas for skill training stages (adopted from 'PoST' framework; [1])*

| 2018 | June | July | August | September | October | November | December | |
|---|---|---|---|---|---|---|---|---|
| Monday | | | | | | | | Monday |
| Tuesday | | | | | | | | Tuesday |
| Wedensday | | | 1 Training | | | | | Wedensday |
| Thursday | | | 2 Training | | | 1 Saarbrücken (A) | | Thursday |
| Friday | 1 | | 3 Training | | | 2 Training | | Friday |
| Saturday | 2 | | 4 Waldhof Mannheim (H) | 1 Homburg (A) | | 3 OFF | 1 OFF | Saturday |
| Sunday | 3 | 1 OFF | 5 OFF | 2 OFF | | 4 OFF | 2 OFF | Sunday |
| Monday | 4 | 2 Travel TL | 6 Training | 3 Training | 1Training | 5 Training | 3 Training | Monday |
| Tuesday | 5 | 3 TL | 7 Training | 4 Training | 2 Training | 6 Training | 4 Training | Tuesday |
| Wedensday | 6 | 4 TL | 8 Balingen (A) | 5 Training | 3 OFF | 7 OFF | 5 Training | Wedensday |
| Thursday | 7 | 5 TL | 9 OFF | 6 Training | 4 Training | 8 Training | 6 Training | Thursday |
| Friday | 8 | 6 TL | 10 Training | 7 Training | 5 Training | 9 Training | 7 Training | Friday |
| Saturday | 9 | 7 TEST (Vik. Aschaffenburg (A), 1600) | 11 Training | 8 Elversberg (H) | 6 Training | 10 Training | 8 Balingen (H) | Saturday |
| Sunday | | 8 Travel TL | 12 Pirmasens (H) | 9 OFF | 7 Training | 11 Stadtallendorf (H) | 9 OFF | Sunday |
| Monday | 11 | 9 OFF | 13 OFF | 10 Training | 8 Stuttgart II (H) | 12 OFF | 10 Training | Monday |
| Tuesday | 12 | 10 Training | 14 Training | 11 Training | 9 Training | 13 Training | 11 Training | Tuesday |
| Wedensday | 13 | 11 TEST (Bissingen) | 15 Training | 12 Training | 10 Training | 14 Training | 12 Training (Test Performance) | Wedensday |
| Thursday | 14 | 12 Training | 16 Training | 13 Training | 11Training | 15 Training | 13 Training | Thursday |
| Friday | 15 | 13 Training | 17 Training | 14 Walldorf (A) | 12 Training | 16 Training | 14 | Friday |
| Saturday | 16 | 14 TEST (Vik. Koln (A), 1530) | 18 Kicker Offenbach (A) | 15 OFF | 13 Hessen Dreieich (H) | 17 Training | 15 | Saturday |
| Sunday | 17 | 15 OFF | 19 OFF | 16 OFF | 14 OFF | 18 OFF | 16 | Sunday |
| Monday | 18 Training | 16 Training | 20 OFF | 17 Training | 15 Training | 19 Training | 17 | Monday |
| Tuesday | 19 Training | 17 Training | 21 Training | 18 Training | 16 Training | 20 Training | 18 | Tuesday |
| Wedensday | 20 Training (Test Performance) | 18 Training | 22 Training | 19 Training | 17 Training | 21 Training | 19 | Wedensday |
| Thursday | 21 Training | 19 Training | 23 Training | 20 OFF | 18 Training | 22 Training | 20 | Thursday |
| Friday | 22 Training | 20 TEST (CfR Pforzheim (A), 1900) | 24 Training | 21 Training | 19 FSV FRA (A) | 23 Steinbach (H) | 21 | Friday |
| Saturday | 23 Training | 21 Training | 25 Wormatia Worms (H) | 22 Training | 20 OFF | 24 Training | 22 | Saturday |
| Sunday | 24 OFF | 22 OFF | 26 OFF | 23 Mainz (H) | 21 OFF | 25 OFF | 23 | Sunday |
| Monday | 25 Training | 23 Training | 27 Training | 24 OFF | 22 Training | 26 Training | 24 | Monday |
| Tuesday | 26 TEST (Arminia Ludwigshafen (H), 1900) | 24 Training | 28 Training | 25 Training | 23 Training | 27 Training | 25 | Tuesday |
| Wedensday | 27 Training | 25 Training | 29 Training | 26 Training | 24 Training | 28 Training | 26 | Wedensday |
| Thursday | 28 Tests/ Training | 26 Training | 30 Training | 27 Training | 25 Training | 29 Training | 27 | Thursday |
| Friday | 29 Tests/ Training - GK COACH MEETING | 27 Training | 31 Training | 28 Ulm (A) | 26 Freiburg (H) | 30 Mannheim (A) | 28 | Friday |
| Saturday | 30 OFF | 28 Training | | 29 Training | 27 Training | | 29 | Saturday |
| Sunday | | 29 TSV Steinbach (A) | | 30 OFF | 28 OFF | | 30 | Sunday |
| Monday | | 30 OFF | | | 29 Training | | 31 | Monday |
| Tuesday | | 31 Training | | | 30 Training | | | Tuesday |
| Wedensday | | | | | 31 Training | | | Wedensday |

| 2019 | January | February | March | April | May | June | July | |
|---|---|---|---|---|---|---|---|---|
| Monday | | | | 1 Training | | | | Monday |
| Tuesday | 1 | | | 2 Training | | | | Tuesday |
| Wedensday | 2 | | | 3 OFF | 1 OFF | | | Wedensday |
| Thursday | 3 | | | 4 Training | 2 Training | | | Thursday |
| Friday | 4 | 1 Training | 1 Kickers Offenbach (H) | 5 Training | 3 Training | | | Friday |
| Saturday | 5 | 2 TEST (Mutschelbach (A), 1130) | 2 OFF | 6 SSV Ulm (H) | 4 Freiburg II (A) | | | Saturday |
| Sunday | 6 | 3 OFF | 3 OFF | 7 Training | 5 OFF | | | Sunday |
| Monday | 7 | 4 Training | 4 Training | 8 Training | 6 Training | | | Monday |
| Tuesday | 8 | 5 Training | 5 Training | 9 Walldorf (H) | 7 Training | | | Tuesday |
| Wedensday | 9 | 6 Training | 6 Training | 10 OFF | 8 Training | | | Wedensday |
| Thursday | 10 | 7 Training | 7 Training | 11 Training | 9 Training | | | Thursday |
| Friday | 11 | 8 Training | 8 Wormatia Worms (A) | 12 Training | 10 Training | | | Friday |
| Saturday | 12 | 9 TEST (CfR Pforzheim (H), 1300) | 9 Training | 13 Training | 11 Training | | | Saturday |
| Sunday | 13 | 10 OFF | 10 OFF | 14 Stuttgart II (A) | 12 FC Saarbrucken (H) | | | Sunday |
| Monday | 14 Training | 11 Training | 11 Training | 15 OFF | 13 OFF | | | Monday |
| Tuesday | 15 Training (Tests Performance) | 12 Training | 12 Training | 16 Training | 14 Training | | | Tuesday |
| Wedensday | 16 TRAINING CAMP (Schwarzwald) | 13 Training | 13 Homburg (H) | 17 Training | 15 Training | | | Wedensday |
| Thursday | 17 TRAINING CAMP (Schwarzwald) | 14 OFF | 14 Training | 18 Training | 16 Training | | | Thursday |
| Friday | 18 TRAINING CAMP (Schwarzwald) | 15 Training | 15 Training | 19 Training | 17 Training | | | Friday |
| Saturday | 19 OFF | 16 Training | 16 Elversberg (A) | 20 Hessen Dreieich (A) | 18 Stadtallendorf (A) | | | Saturday |
| Sunday | 20 OFF | 17 TEST (Mannheim (H), 1200) | 17 OFF | 21 OFF | | | | Sunday |
| Monday | 21 Training | 18 OFF | 18 Training | 22 Training | | | | Monday |
| Tuesday | 22 Training | 19 Training | 19 Training | 23 Training | | | | Tuesday |
| Wedensday | 23 Training | 20 Training | 20 Training | 24 Training | | | | Wedensday |
| Thursday | 24 Training | 21 Training | 21 Training | 25 Training | | | | Thursday |
| Friday | 25 Training | 22 Training | 22 Training | 26 Training | | | | Friday |
| Saturday | 26 TEST (Göppinger SV (H), 1400) | 23 FK Pirmasens (A) | 23 OFF | 27 FSV Frankfurt (H) | | | | Saturday |
| Sunday | 27 OFF | 24 OFF | 24 OFF | 28 OFF | | | | Sunday |
| Monday | 28 Training | 25 Training | 25 Training | 29 Training | | | | Monday |
| Tuesday | 29 Training | 26 Training | 26 Training | 30 Tests (Performance) | | | | Tuesday |
| Wedensday | 30 Training | 27 Training | 27 Training | | | | | Wedensday |
| Thursday | 31 Training | 28 Training | 28 Training | | | | | Thursday |
| Friday | | | 29 Mainz (A) | | | | | Friday |
| Saturday | | | 30 Training | | | | | Saturday |
| Sunday | | | 31 OFF | | | | | Sunday |
| Monday | | | | | | | | Monday |

| Labels: |
|---|
| Travel/ Training Camp |
| (TEST) GAME |
| OFF DAYS |
| EVENTS |
| COORDINATION TRAINING |
| SKILL ADAPTABILITY TRAINING |
| PERFORMANCE TRAINING |
| BREAK - Winter/ Sommer (including fitness plan) |

*Figure 3: The pre-planned GK training calendar for the 2018/19 season (i.e., macro-level skill training periodisation)*

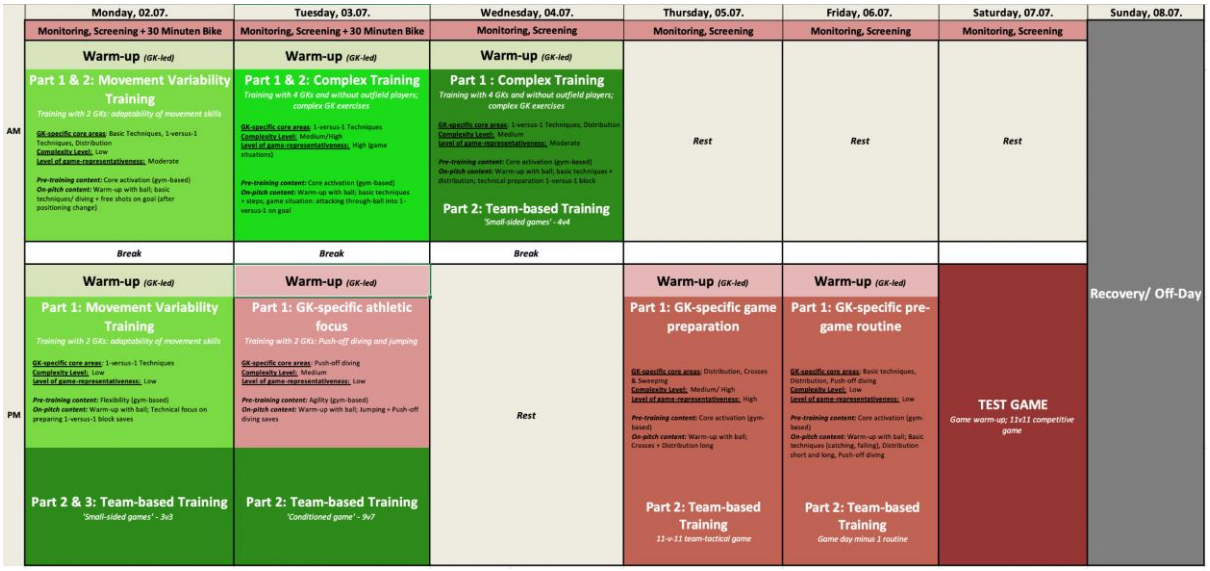



*Figure 4: Pre-scheduled training planning for an exemplary U23s GK training week*

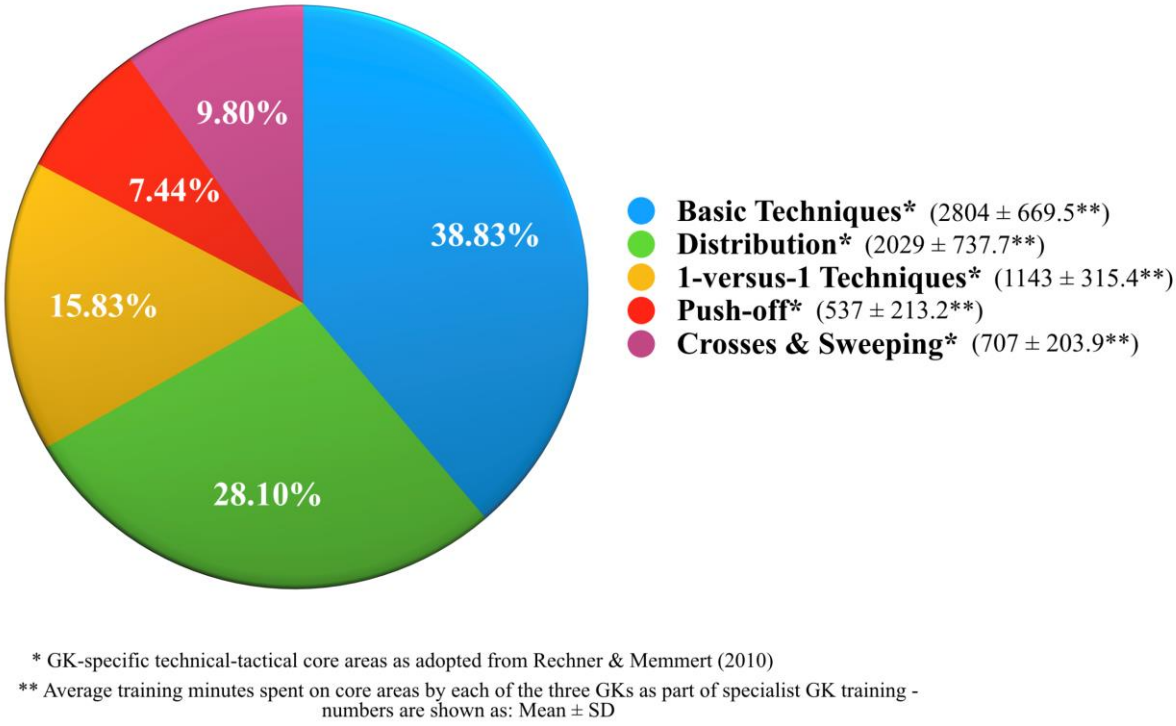
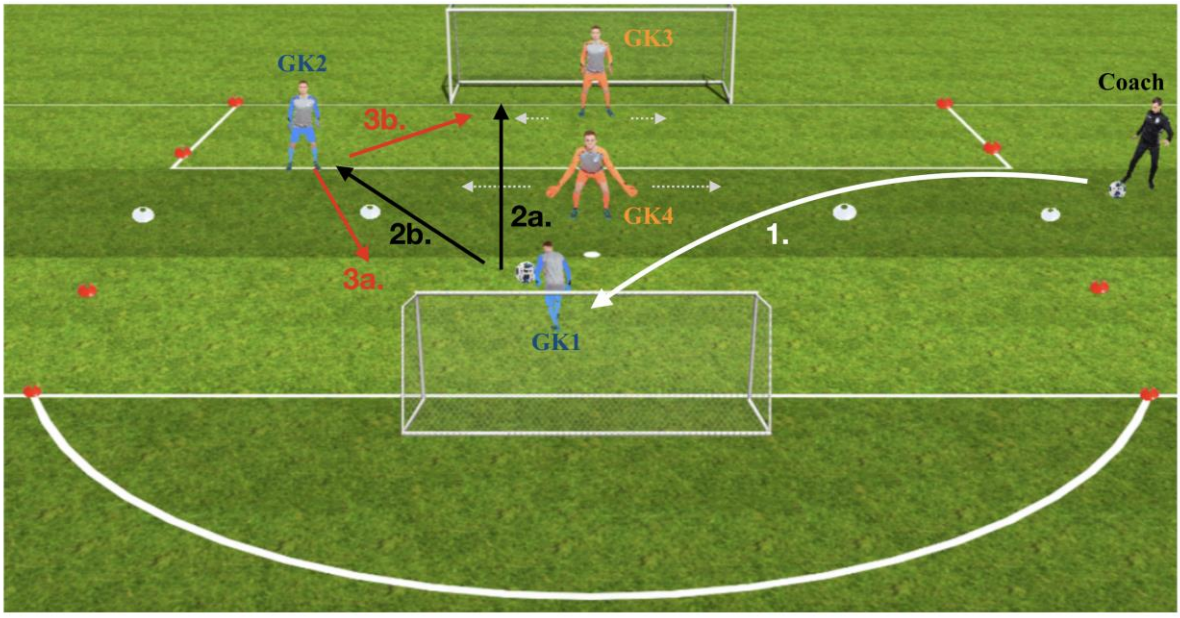



*Figure 5: Training analysis of GK-specific technical-tactical core areas (2018/19 season)*




**Set up:** **1. Ball played into GK1 from Coach**

**2. GK1 and GK2 can initiate an attack on the goal defended by GK3 and GK4**

**2a. GK1 can attack directly on goal (GK3 & GK4)**

**2b. GK1 can pass the ball to GK2 (in opponent half of the field) - GK4 can intercept the pass if possible**

**3. If ball is played to GK2:**

**3a. GK2 can pass ball back to GK1 to keep possession**

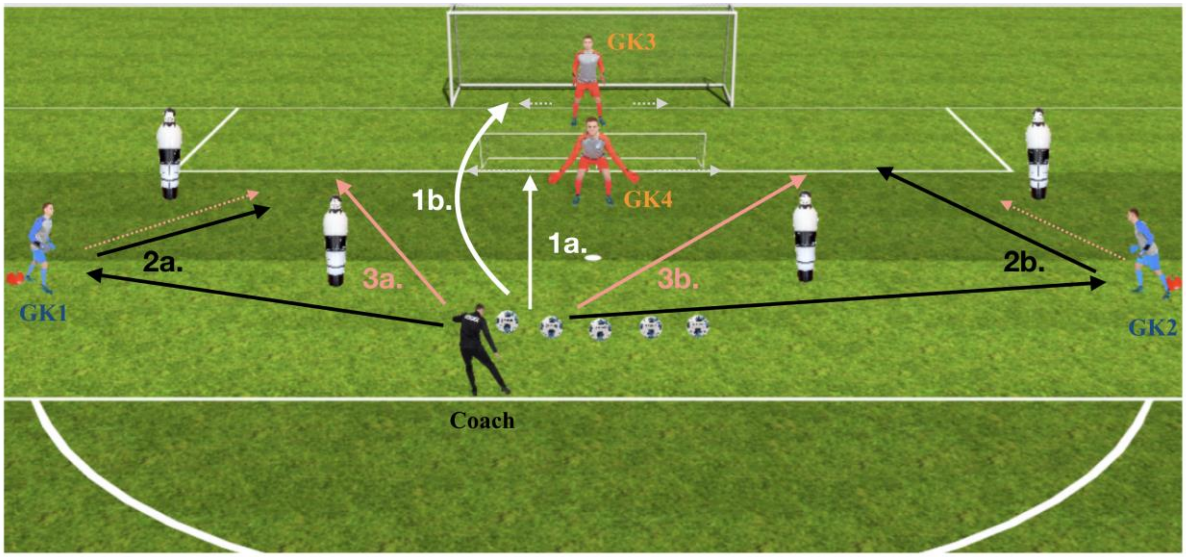
**3b. GK2 can attack on goal (GK3)**

**Equipment:** **- 2x small football goals**

**- coloured cones to mark playing field**

*Training graphic illustrated with the Goalkeeping Development GmbH (2020) software*

*Figure 6: Training example 1 – complex 2-versus-2 GK game.*




**Set up:** The Coach has 5-6 balls lined up prior to starting each training round and has the following options:

1a. The Coach can shoot on GK4 covering the two small football goals

1b. The Coach can shoot on GK3, who is defending the regular-sized football goal

2a/b. The Coach can pass the ball to either GK1 or GK2, who attacks on the regular-sized football goal with a maximum of 2-3 touches

3a/b. The Coach can pass the ball through into GK1's/ GK2's run, who has to finish with the first touch

**Equipment:**
- 2x small football goals
- 1x regular-sized football goal
- coloured cones to mark playing field
- 4x Dummies

*Training graphic illustrated with the Goalkeeping Development GmbH (2020) software*

*Figure 7: Training example 2 – complex GK training exercise.*

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