Science in Coaching

Resource: Constraints Led Approach for Athletes

This resource covers learning outcome 2 for all coaching communities.

Coaching is often described as an 'art', but effective coaching requires the coach to design a programme that is based on a sound scientific knowledge base. Without this knowledge, programmes are likely to be at best ineffective and at worst dangerous. For those who aim to be sport scientists, a typical sport science course includes separate papers in areas such as anthropometry, biomechanics, nutrition, physiology and sport psychology. Although, the "mono-disciplinary" approach enables "specialists" to deliver informative and up to date knowledge in their respective disciplines, there are a number of important consequences for the coach. For instance, when high performance teams' use sport science support they may employ a strength and conditioning specialist, a sport psychologist, a nutritionist and a biomechanist. However, a coach of childhood or teenage athletes needs to take on an element of all these roles to help their athletes perform.

The coach is an "inter-disciplinarian", who has to have an understanding of how to construct a training programme that considers and *integrates* all areas that affect performance. As such, the key challenge is how coaches integrate the vast amounts of sport science information into their training and competition programmes. A useful framework for understanding how to do this is a model of skill learning called the ***constraints-led approach***.

Constraints

In this model, constraints are not always limiting or negative factors. They are all the factors that influence learning and performance at any moment in time. Constraints can refer to the ***individual,*** the ***environment*** and ultimately ***the task***. Figure 1 below illustrates the overview of the model.

Figure 1: The Constraints-led Approach to Coaching
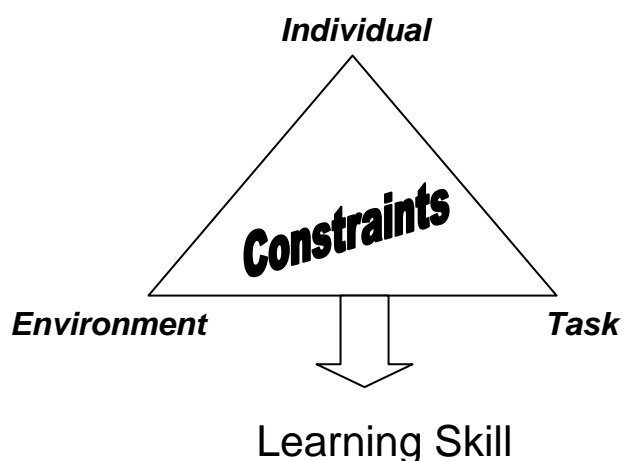
The individual, environmental and task constraints all interact in order to determine the way that a performer completes a goal related task. ***Individual constraints*** include factors such as body size (height, weight, and limb lengths), fitness (e.g., strength, speed, aerobic capacity, and flexibility), mental skills (e.g. concentration, confidence, emotional control or motivation), perceptual and decision-making skills (e.g. recognising patterns of play, anticipating by reading the movements of opponents) and personality factors (e.g. is a risk-taker, or likes to play safe).

Environmental constraints include both physical and social environmental factors. Physical factors include gravity, ambient temperature, natural light, terrain, auditory feedback or other environmental features that are not usually adaptations of the task. These constraints could include cultural norms (e.g. India produces great spin bowlers), as well as family support networks, peer groups, societal expectation (e.g. the expectation that players will be rugby players in New Zealand, soccer players in England and basketballers in New York).

Finally, ***task constraints*** are factors that are usually more closely related to performance and include the rules of the sport, equipment used such as bats, rackets, and clubs in golf, pitch sizes and player numbers.

Coaches need to <u>understand how rules</u> of the game play a major role in determining skills, strategies and tactics used during competitions. For example, in touch rugby, when children do not yet have the ability to pass sideways faster than a defender can run the passing distance, the most common way of scoring is for the players to run "around" the defence. In this case, 'go forward' (a common coaching point in rugby) will result in the player being touched and having to give the ball away.

Other task constraints include the pitch sizes and team numbers for games and competitions. In many team sports, the importance of familiarity with <u>pitch dimensions</u> is apparent with common recognition of the home advantage effect.

> ### Middle/Late Childhood and Early Teenage Coaching Communities
> *In children's sport administrators often make the mistake of playing children's sports on adult size pitches, with adult size goals and equipment. This is often done with the desire to get children playing the 'real' game as soon as possible. However, the individual constraints often lead to children having to develop unique solutions to performance demands. For example, the picture below shows a young basketball player's solution to being required to shoot a full size basketball into a hoop set at adult height.*

Another important task constraint is <u>team size</u>. Just like pitch dimensions, many sports set up competitions that mimic the adult versions of their sports.

> ### Middle/Late Childhood and Early Teenage Coaching Communities
> *Playing with adult team sizes can be detrimental to children's development. When researchers at Manchester United football club changed the games of their Academy players from 8 vs 8 to 4 vs 4, they were amazed to find that the number of shots, passes and one-on-one challenges increased far more than the double they would have expected. They pointed out that the use of small-sided games meant that the young players were required to perform a greater number of skills resulting in rapid technical and tactical development of the players.*

One final task constraint that needs to be mentioned is <u>instructions</u>. Instructions given by coaches about how to complete a task play a major part in determining how an athlete will attempt to achieve the set goal. Coaches need to understand that the instructions they give will determine the movements that the athletes produce to achieve the set goals. Instructions can act as a limiter to performance and discourage athletes from exploring different movement solutions.

During performance, the nature of the task provides the overarching constraint that shapes performance. In practice, coaches can manipulate the task constraints in order to direct the athletes' search for solutions.

Summary
Coaches can use their understanding of a constraints-led approach to manipulate key factors that underpin performance to provide effective coaching programmes. The science in coaching module has first provided you with key knowledge for each of the sport science disciplines, before concluding by looking at the key principles of skill acquisition to show you how you can use the constraints-led approach to enhance your coaching practices.

Practical Considerations:

The following are ideas on adapting task constraints for different sports codes

1. For net games coaches
The court dimensions can be changed to enable the athletes to work on specific aspects of their game?

> **Hints**
> For net games, think how a narrow, long thin court can be used to make a game which will help to improve player's concentration and consistency. Make a no go area in the middle area of the court can help players to hit short or long.

2. For striking and fielding coaches
Change the boundary dimensions to enable players to develop technical skills at the same time as developing decision-making skills.

> **Hints**
> Create small-sided games that have scoring zones and a limited number of fielders.

3. For target game coaches
Adapt the practice environments to force athletes to develop specific technical skills or to make tactical decisions.

> **Hints**
> Place obstacles on the course, rink, etc to force the players to solve problems through developing a range of skills or to force them to make choices,

4. For running, cycling, swimming coaches
Design practice 'courses' that set decision-making problems for the athletes?

> **Hints**
> Design courses that provide variety and choices for the athletes. Replicate typical problems athletes face in competitions (e.g., design activities that force them to make tactical choices).

The path to achieving great skill

Many arguments about what highly successful athletes do in their training to learn their skill have been highlighted in research. Though there is no absolute fact about what these athletes do (as they are all individuals and have unique experiences), in the quest to determine what brings about greatness, research undertaken to date seems to suggest:

- Participating in many different sports at a young age has a positive influence on future success.
- The first coach is critical to create the climate to hook the child into the sport.
- All future champions initially go through a 'romance' phase early in their careers, meaning that they seem to fall in love with their sport and therefore become very passionate about their performance.
- There are as many differences as there are similarities between the athletes.
- Comparisons of individual differences among athletes and the different environments in which they develop their skills, suggest that athletes develop unique techniques that are specifically suited to each of them individually.

Each bullet point deserves a little further explanation. The first bullet point reminds us of the importance of young sport participants having a broad movement vocabulary based on involvement in a wide range of sports. There is sometimes a tendency to have young people specialise too early as mistakenly, coaches and parents believe that this is the pathway to greatness. It is true that for a few sports (eg. gymnastics), early specialisation is important to develop the levels of joint mobility required for mastery. However, in general terms, great athletes have enjoyed a wide range of sports at a young age and have only specialised often around the age of 15-16 years.

Also emerging from the literature is the importance of "first coaches" who create the environment that "hooks" the athlete. These are coaches who are able to provide the psychosocial environment that result in the athlete having a great sport experience and this can result in the commencement of the 'romance' period when the athlete falls in love with the sport. Maybe this love of the sport is a necessary pre-requisite as other researchers have found that on average, most champions have undertaken in the region of 10, 000 hours of practice in order to reach the top.

Table 1 below highlights some of the key implications of the constraint-led approach to coaching (adapted from Williams & Hodges, 2005).

Table 1: Williams and Hodges Summary

Demonstrations may actually limit potential as they are over constraining and force the learner to adopt a movement pattern that may not be the most effective for the individual. A **demonstration** should always be coupled with its outcome effects so that learners are encouraged to problem solve and determine how their actions and effects are related.

Allow learners to **observe a range of people** doing **demonstrations** so they can appreciate subtle variations in technique and how it alters outcomes.

The **problem solving approach** (setting problems for athletes to solve or posing questions) encourages learners to take more responsibility for their learning.

There are **different ways to achieve the same end result** and learners should be encouraged to explore these opportunities so as to develop flexible and adaptable movement patterns.

Performance in practice should not be seen as a sole measure of the effectiveness of coaching. The most appropriate measure is to **observe the learner in competition**.

Practice should be as variable as possible so that learners can explore and discover their own solutions.

The practice session should mimic **the range of variations** experienced during a match.

Blocked practice helps to develop confidence. Blocked practice is repetitive practice to hone in on technique or skill.

Small sided games are more effective for learning skill than drills.

Providing feedback on every practice attempt limits learning potential as it prevents the learner from searching for solutions. Encourage learners to increase their own ability to use **intrinsic feedback** (feedback about their own movements).

Over prescriptive coaching may be detrimental to learning.

Using **guided discovery** enables learners to take more responsibility for their own development.

Coaches should **manipulate the individual, environmental and task constraints** to help shape the learners performances through guided discovery and self-exploration.

In the **constraints-led approach,** coaches shape and guide rather than direct.
Game intelligence can be developed by the use of game related activities.

Summary

Coaches should not force all athletes to try to fit into a perfect movement template often highlighted in many textbooks as the one way of performing a movement. In general, as long as the biomechanical principles of the movement are sound and the movement is not going to cause injury, good coaches allow their athletes to solve problems in ways that are best suited to their own individual constraints. The key point for coaches is therefore, encourage athletes to solve problems using techniques that are most suitable to them individually.

Reference

Williams, A.M. & Hodges, N.J. (2005). Practice, instruction and skill acquisition: Challenging tradition. *Journal of Sport Sciences,* 23(6), 637-650.