Mastering Skills in Sports

A guide to the Skill Acquisition Periodization (SAP) Framework

Assumptions we make

I think we mostly assume that athletes have the skills they need to participate in whatever level of sport they are in.

We forget that most athletes begin their sports journey organized by age and weight - things that have nothing to do with skill. This categorization often persists until high school, wherein athletes of all skills and sizes are grouped together, and the cream supposedly rises to the top.

After several years of seeing 19-year-old pro athletes up close and personal, it's clear there are definitely some skills we still need to develop.

If you travel to organizations across the country, you largely see the exact same approach to building skills: reps. Volume of reps. Thousands and thousands of shots, with (maybe) some minor corrections along the way. We evaluate whether or not a shot is good not by the skill displayed but by the outcome we care about.

I suspect this is because measuring skills is actually quite difficult.

Even if we know what a good shot looks like, for example, it can be difficult (if not impossible) to make educated inferences about what's happening during the execution of the skill if all we have is our own observation. How can you realistically track where a player is looking, the position of their feet, the position of their shoulder, and their follow-through all at the same time?

The real answer (probably) is that you can't. So we settle for a proxy: is it in or out? Did it look good or not?

We need a more structured, robust way of understanding whether or not an athlete is making progress. We need a way to determine if the component parts of a skill are being executed well - not just if the outcome looks the way we want to.

We need to know how to actually coach people to get better.

The Concept of Periodization

Though it's slightly different from a skill in its purest form, we do actually have a decent framework for how we help people develop physical capabilities in sports.

Periodization.

Periodization is all about "systematic variations" in the way we train "at regular intervals with the aim of improving performance (Farrow & Robertson, 2016; Fleck, 1999).

Basically, we use short-term and long-term planning to identify what an athlete should do and when, record the outcomes, review, and adjust. Over time and following a few key principles (e.g., progressive overload), we are able to reasonably predict someone will get "better" (stronger, faster, etc.)

What if we took the same concept and applied it to the development of skills?

The SPORT Periodization Framework (For Physical Training and Skill Alike)

Farrow & Robertson (2016) provide us with a framework adapted from physical training that we could use to build skill over the short- and long-term in elite sports.

S: Specificity

P: Progression

O: Overload
R: Reversibility

T: Tedium

SPORT.

Let's take these principles one at a time.

Specificity

Specificity is just the degree to which training reflects competition.

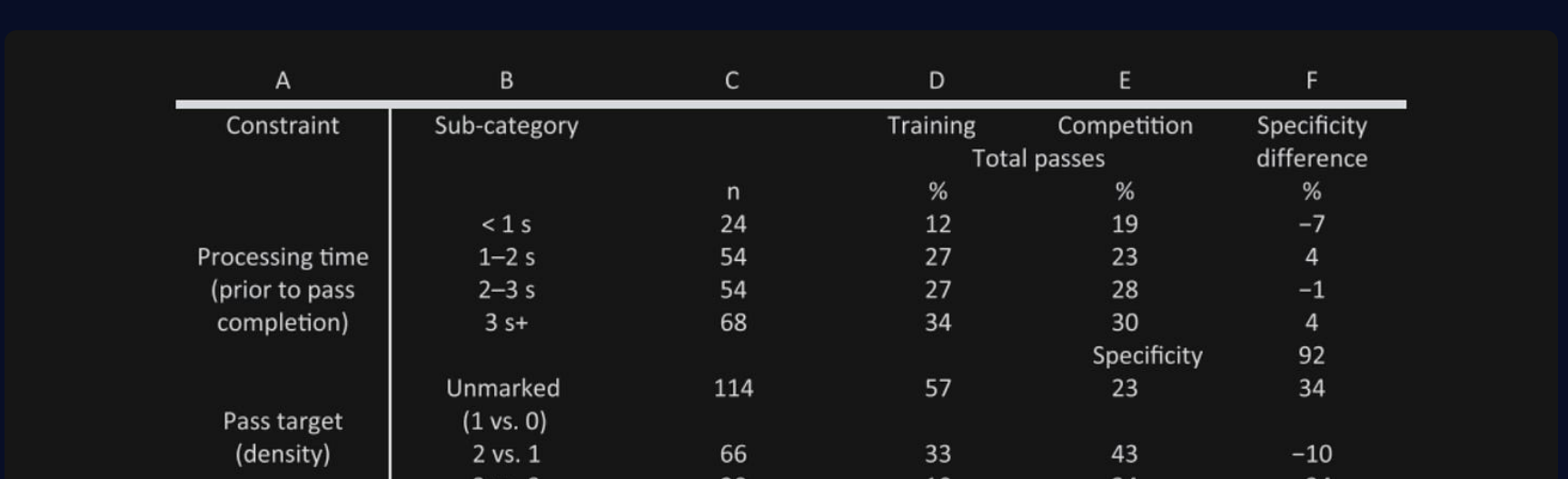
When we're planning for specificity, we are looking for the training to have a high degree of "representativeness" - the tasks we ask players to do in practice should reflect what's demanded of them in a game.

The way to do this is by messing with the constraints. We have to try and make the practice look and feel like a game so that players can learn to match specific actions to information they might find in a real-life scenario. To adjust, you can play with:

- Individual variables and rules, like doing this training after a heavy lift or toward the end of practice
- Environmental variables, like loud music or who's on the opposing team
- Task variables, like only being able to shoot after 3 passes have been completed

Practicing like this is also more demanding, both physically and mentally for players. If we use representative training, we can shorten our practices and be more effective at the same time.

If you want to see what tracking specificity might look like in practice, here's an example, taken from Farrow & Robertson, 2016.



A	B	C	D	E	F
Constraint	Sub-category		Training	Competition	Specificity difference
			Total passes		
		n	%	%	%
Processing time (prior to pass completion)	< 1 s	24	12	19	−7
	1–2 s	54	27	23	4
	2–3 s	54	27	28	−1
	3 s+	68	34	30	4
				Specificity	92
Pass target (density)	Unmarked (1 vs. 0)	114	57	23	34
	2 vs. 1	66	33	43	−10
	3 vs. 3	20	10	34	−24
				Specificity	66
Pitch size	Quarter	20	10	0	10
	Half	44	22	0	22
	Full	136	68	100	−32
				Specificity	68
				Specificity (total)	75

Fig. 1 Example of how specificity can be assessed in a skill-based training session. Three examples of skill constraints are provided; quantifying the prevalence of each allows for direct comparison of training with competition conditions. The difference between the two sets of conditions represents the level of training specificity

Here, you can see that they track the type of passes, percentage in training and competition, and time (the example is a pass in soccer). What matters most here is the percentages in columns D, E, and F - the closer the percentage match between training and competition, the more representative the practice.

Progression

In the context of training, progression can really mean 2 things: (1) getting better overall at the skills we need to execute, or (2) increased capacity to do more and take on a higher load.

When it comes to expert performance, the concept of deliberate practice (the real, scientific one - not the BS 10,000-hour rule) - comes into play.

Ericsson, Krampe, and Tesch-Romer (1993) noted that an expert "deliberately constructs and seeks out training situations in which a set goal exceeds their current level of performance."

They also argued that a coach is responsible for making sure practice matches this demand and that they keep track of progress,

While not the forum to debate deliberate practice and its merits, there is merit to the idea that practice has to be set up in a way where there's a progressive set of goals set, achieved, and moved forward that reflect different skill difficulties relative to current skill levels.

In short, you need:

- High, hard practice goals
- Tasks that build toward accomplishing those goals are based on the athlete's current skill level.

Of note, though the assumption is that practice is always about building skills, there may be times when it's better to forego skill development and instead focus on psychological development. The tasks that help an athlete get better on the court may be the same tasks that undermine an athlete's confidence if they are challenging enough and there's enough failure (after all, they should be failing on roughly 15% of these reps if the task is appropriately difficult).

Overload

Physical training has two types of load: internal and external.

Internal load includes metrics like rate of perceived exertion (RPE) and heart rate. External load includes things measured outside the body, like GPS data, distance covered, or reps completed.

These same concepts can apply to skill training.

Internal load, when it comes to developing skills, is about the cognitive effort it takes to learn something new. External load is as simple as how much practice is done.

It's worth considering here that most practices today place a premium on external load and often deliberately (and misguidedly) try to reduce internal load.

Though cognitive effort is more difficult to measure, one of the more robust findings on the mental load of practice is that blocked practice - the type where someone just takes rep after rep after rep - leads to better practice performance, but poorer skill retention and transfer to the game. This type of practice creates the illusion of improved performance, and coaches are left scratching their heads when the skill they saw in practice doesn't show up in a game.

Random practice, on the other hand, often leads to crappier practices but better skill retention and transfer. It looks like the athlete is struggling, but they're more likely to execute when the time is right. Though random practice is more taxing mentally, the long-term benefits far outweigh the short-term view that poorer practice performance will lead to poorer game performance.

This doesn't mean there's no time and place for repetition. When you're teaching a new skill, the person is a novice, or you're trying to correct one thing, repetition, and blocked practice can be helpful. But as the skill gets more complex and the player more talented, skill development needs variation.

A simple rule can work wonders here: once the skill seems consistent, this is a sign to change the practice to increase the load.

Reversibility

If you stop going to the gym, you won't lose all your muscle mass in a week. But over a period of 4-6 weeks, you might slowly lose some strength, and the fluidity of the movement, and go through "detraining" a bit. Once you resume, the skill and strength come back, but it takes a little bit of time.

Physical skill isn't much different, though the retention of skill is a bit stickier long-term than the retention of strength.

The question, then, is whether or not the training undertaken will lead to any reversibility, or if the athlete will retain what they've been taught and transfer it to a game over time.

The main mechanisms to attend to here are observation (does the skill look better after practicing?), retention (does the skill look the same after some time away?), and transfer (does the skill show up in games?)

The higher the rate of retention and transfer, the stickier the skill and the less likely it is to reverse.

The main takehome here is not to assume that time away means the skill will be lost, but to make sure you're monitoring the differences in skill execution before and after a break, and ramping up accordingly.

We know that recovery - sleep, naps, rest, time away - is beneficial for consolidating learning and skill development, so it's not a question of whether or not you should continue training. Instead, it's about making sure the training you do is structured well enough to have the skill stay.

Tedium

Tedium, or doing the same thing again and again to the point of stalling, is what we want to try and avoid. Novelty forces new learning - the brain's predictions are forced to adapt to a new set of circumstances, and our mental model is forced to be updated. Doing the same thing over and over again (unfortunately, like I've seen at far too many practices), doesn't lead to development.

It leads straight to stagnation.

We need variation to keep getting better. Plus, no two moves are ever the exact same - even the best shooters in the NBA, as tracked by biomechanics technology, still have slight variations in their shots. The dynamic environment of sports means that there are always going to be varying circumstances for athletes to respond to, and practice should mimic that variation.

Here's a look at what good variation might be like.

Tedium continuum	HIGH				LOW
Skill practice approach	Constant practice	Blocked practice	Variable practice	Random practice	Differencial practice
	Repeat the same skill in the same manner on each repetition	2 or more skills practised in blocks (i.e., kick, kick, kick, volley, volley, volley)	Vary the one skill via changes in distance, force etc.	2 or more skills randomly interpersed across practice (kick, volley, volley, kick…)	Vary the one skill every practice repetition (i.e., kick using different approaches to the ball)
Environmental demand	Low representative / controlled / drill		Semi-controlled / drill-game		Representative / open-ended game
	No defence		Passive defence		Active defence
	Unrestricted time in ball possession		Time limted ball possession		Severe time limits on ball possession
	Large amount of playing space		Reduced playing space		Varying playing space
Cognitive effort / load	SIMPLE LOW				DIFFICULT HIGH
Performer	UNSKILLED				SKILLED

Fig. 5 Example of a method to quantify tedium (variety) on a continuum. The level of tedium, practice format and approach, environmental demand, cognitive load and skill level of the performer are all considered. While each of the qualities is described separately they are interactive in nature. For example, one could prescribe a low representative/controlled drill with random practice

As you can see, there is a lot you can do to stave off tedium. Try varying the tasks, making them harder or easier, or changing the environment. You might play small-sided games, change the spacing around a player, or develop rigid rules to make a task more complex.

Whatever you choose, remember that the increase in novelty is likely to help your players learn.

As a bonus, it also increases engagement - novelty requires a new focus, which makes the quality of practice higher.

Putting it into Practice

Following the basic principle of this model - that varied, engaging training that builds over time leads to better skill - can become a simple north star for how you evaluate your practices and the work you do.

Did we mix it up enough today?

Was it challenging enough?

Did we introduce new constraints?

If you're consistently answering no to 2/3 of these questions, it might be time to change it up.

The SPORT framework gives us a starting point for making practice more effective and for helping athletes effectively learn new skills. But if you try to apply it all at once, just like anything, it might prove to be too much and less sticky.

My recommendation: pick just one area, and start working on it.

References

References:

A special thanks to Joe Baker, who shared this article with me.

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