BUDD SYMES/ALLSPORT

Where The Weightroom Meets The Classroom

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IF YOU COMPARE THE SPORTS training scene in American high schools with that in Eastern Europe, you will find two essential differences:

1. We tend to miss the opportunity to fully develop the adolescent athletes' abilities. Muscle strength and mass aren't the only neglected qualities. Flexibility, coordinative ability and overall athleticism are detrimentally affected as well.

2. Our strength training methods often inhibit rather than excite the athletes' neuromuscular activity. Virtually every traditional approach that we use induces fatigue more so than optimal activation.

The good news is that most athletes' needs are so remedial at this point that virtually anything seems to work. However, the situation may not be as simple as it appears. Consider an educational analogy where a 12-year-old student drops out of school after sixth grade, and then attempts to enroll in college at the age of 18. The problem isn't just one of deficient knowledge base, but also of learning skill.

Even with a genius level IQ his/her inadequate preparation would require corrective teaching. All too often the same situation exists with athletic ability and coaching. A half-baked training program can yield results, but the application of some basic rules will yield better results.

In my experience, most teenage athletes' greatest need is a general increase in power output. In most cases there is such a range of abilities to shore up — and so much intermediate ground to cover — that training tactics don't need to be too advanced or specialized.

Now let me qualify this by stating that "structural" training isn't the only answer. Think about what's involved in executing any athletic technique: Power is applied through a movement path, often repetitively, and must be controlled. Sound training should therefore address mobility, endurance and motor skill, as well as muscle mass and strength. The point is that we're talking about tuning the machinery as well as building it. Here's where the answer really is as straightforward as it seems.

Simple Strength Science

When looking for the best way to train our students as athletes, we don't have to look any further than the elementary laws we're teaching them in science class. Of all the equations I learned in high school physics, there are three I wish I

would have had more appreciation for in the weightroom:

● **Power = force x velocity.** A critical velocity or power output is required to execute any skill. This is especially true in sports. Depending on the movement, power production usually peaks at 30–50% of maximum force and/or velocity. This isn't meant to imply that we should abandon heavy resistance training, but does mean that the range of productive workloads extends well beyond the "slow squeeze" zone.

● **Impulse = force x time.** This is an even better example of the explosive force concept. In order to execute athletic movements, the object must be rapidly moved through an acceleration path, with peak force being applied for a very short time (i.e. typically about 0.1 – 0.2 second, whereas absolute maximum force development requires 0.6 – 0.8 second). Continuous, prolonged force application is not the answer. Brief, explosive force production is; and is what separates the good athletes from the not-so-good ones.

● **Force = mass x acceleration.** This may be the most deceptively simple of these laws, but has the greatest potential to end the nonsense taking place in many weightrooms. Once the weight is determined, maximal force (relative to one's strength capabilities) and motoneural activity are only generated when maximally accelerated. In fact, since any movement is essentially an act of defying gravity — which itself is an accelerative force — the central issue becomes: What's being moved, and how fast?

The operative concept in each case is speed-strength. Many people mistakenly believe that speed is independent from (or incompatible with) strength, when in fact velocity is the result of explosive force. This makes perfect sense if you think about any sport skill in simple mechanical terms. Swinging a baseball bat, throwing or kicking a football, putting the shot, and driving off the ground while running or jumping are all based on the same principle: The athlete briefly gets into a "power position" and then accelerates into the action as explosively as possible.

This criterion should also be used to gauge the usefulness of any training exercise, and is the reason that movements like olympic-style lifts, plyometrics and medicine ball drills are so effective. There's no way to perform them without high power production, rapid force application or acceleration — which is precisely why they "dynamically correspond" with so many athletic activities, and deserve high priority in training.

Powerful Stuff

It's a shame that these laws get buried in the deluge of information presented in science class. They are foundational principles upon which all motion is based, with strength training being no exception. Aside from the obvious fact that heavy weights can't be lifted as rapidly as light ones — and that some movements are inherently ballistic, where the weight (or body) is launched, while others aren't — there are two other points to consider:

1. Rate of force production is as important — and trainable — as amplitude. As previously mentioned, a basic goal of most athletic skills is to minimize the time required to execute them. This in turn dictates the amount of force that can be generated. Some coaches and athletes incorrectly believe that rate of force development is only relevant during ballistic movements, but not during basic weight training exercises (e.g. where the object isn't released). As we shall see, however, brief application of peak force may not be such unfamiliar territory in the latter case after all.

2. The intent to move explosively can be more important than actual velocity achieved. Full voli-tional effort — i.e. a deliberate attempt to maximally accelerate the resistance, even if it's too heavy to move rapidly — yields the greatest neuromuscular excitation and subsequent adaptive response (I take no credit for pioneering this idea: Dr. Fred Hatfield has advocated "compensatory acceleration" for many years; and "submaximal accelerative efforts" have been a way of life in Eastern Europe for decades with obvious success).

Admittedly it's not difficult to find 'experts' who will endorse any training concept. That's why scientific laws must be used to measure their worth. But any way you slice it, submaximal levels of force production and motoneural activation — which are exactly what occurs if

the weight isn't accelerated to the limits of one's ability — simply don't make sense as a sound means of training. This brings us to an interesting practical issue.

Revisiting The Sticking Point

Consider how the previous discussion ties in with the issue rate vs. duration of force production. Let's take a basic barbell exercise like the squat or deadlift as an example, and assume that the ascent takes about 1–2 seconds to execute (fatigue and/or one-rep-max attempts notwithstanding). The "sticking point" is that region in the range of motion where leverage and resistance interact to create the greatest biomechanical difficulty in moving or controlling the bar.

In this case it resides ~30° above the parallel position and occupies a small portion of the movement, but may in fact occupy a relatively larger segment of the time required to complete it — perhaps as much as 1/3 – 1/2, especially as resistance increases and/or exhaustion sets in. Although there's no wind-up or follow-through into extreme ranges (as occurs in many athletic skills), peak force is still applied very briefly at a specific point.

Earlier I made a case for explosive strength training being not only justified, but essential for most sports. The take-home message here is that rate and amplitude of force developed in the sticking region are more important than the total distance or duration through which it's applied, even if the bar isn't moving very fast. This flies in the face of so-called 'continuous tension' or 'time under tension' theories, as well as the low-power, fatigue-oriented training methods associated with them. Indeed, the anti-explosive school of thought — where acceleration when lifting weights is supposedly harmful or futile — is disregarding a key fact:

Gravity keeps acting on the bar as it picks up vertical speed, and the athlete must continue applying force in order to keep it moving or accelerate it further. While it's true that force output decreases as muscle shortening velocity increases, the notion that momentum takes over and does the work at high speeds is nonsensical.

Returning to our squat/deadlift example, here's how to put this concept into practice (note that this approach can be adapted to other compound exercises as well):

- Sit at a controlled speed into an optimal position; don't "free fall" into the descent.
- Accelerate out of the hole and through the sticking point as powerfully as possible with good form.
- Be careful to throttle down at the top of each rep so the bar doesn't jump off your shoulders or out of your grip.

In my opinion, the simplest way that most athletes can improve their training quality is to "rest pause" between reps as needed to achieve the desired power output.

Quality vs. Quantity

As mentioned earlier, I'm a proponent of remedial strength training for most young athletes. Significant work volume certainly is in order here. However, I also believe that quality must be emphasized over quantity even when strength-endurance methods are being used.

In many weightrooms, unfortunately, volume-oriented thinking is still overemphasized at the expense of intensity. The 'repetition maximum' and 'pump and burn' mentalities tend to misdirect attention from where it belongs — namely, on how to move the weight — and toward counting reps and sets. Even operating on the assumption that resistance changes with rep count, this approach is unsound because it places primary emphasis on a secondary (volume) parameter. There's a better way.

In my opinion, the simplest way that most athletes can improve their training quality is to "rest pause" between reps as needed to achieve the desired power output. This is exactly the opposite of what typically happens: Resistance is instead adjusted to achieve a predetermined rep count. Once again, this approach is nonsensical. We could take another lesson from the international scene, where speed-strength is almost always the primary objective. Each rep is executed with maximal effort in the freshest possible state; and work volume is subdivided into multiple sets of low reps, effectively rest-pausing at every opportunity. Explosive impulse or power is the bottom-line objective. This is the reason why Eastern European workouts are characterized by:

- low rep schemes (seldom venturing above 5, and more typi-

cally 2–3 per set)
- a high number of sets per exercise (typically 5+ in addition to warm-ups)
- multiple (but brief) daily workouts, and remarkable overall work volumes

Prioritizing Training Methods

A hierarchy of strength training methods can be studied largely as a matter of convenience. Rational combination rather than disproportionate or exclusive use of any tactic is the key to applying it, and common sense and creativity are the only limits to how this can be accomplished. Since most school-age athletes' needs are so general, a rule of thumb is to devote equal attention to maximum strength, speed-strength and strength-endurance training methods.

In any case, disregard what they're called, and instead think in terms of what they do and how to complement or contrast them with each other. Make use of all available methods, focus on training effect rather than strength demonstration, and do some strategic planning. Manipulate your adversary — in this case, the body's adaptive mechanisms — by systematically "mixing your plays" to exploit their cumulative and interactive effects.

Practical Recommendations

1. Explosive force application is the basis of strength training for sports. Functional strength is really expressed in terms of acceleration, execution time or velocity — especially in athletics. Training tactics which disregard this fact are fundamentally unsound. Moving through an acceleration path, and applying rapid and/or high-speed force, is the name of the game.

2. Emphasize big basic movements which have the greatest training effects; and use equipment which challenges the athlete to control, direct and/or stabilize it. Muscles act in functional task groups, and must be targeted via force transmission through (rather than isolation within) the body's "kinetic chain". Multi-joint free weight movements are superior in this regard.

3. Distinguish between specificity and simulation. When selecting training movements, think in terms of "dynamic correspondence" — i.e. their basic mechanics, but not necessarily outward appearance, should be similar to those occurring in competition. Most importantly, prioritize exercises according to:
- effort level (power)
- rate and time of peak force production (impulse)

4. Balance the need for specificity vs. variability. Maintain stability in the program by sticking with a basic exercise menu rather than trying to include every possible variation. Cycle the workloads on a "periodic" 3–4 week basis in order to summate their training effects and avoid accommodation.

5. Quality, not quantity, of effort is the bottom line. While it's certainly necessary to do enough work to get a training effect, there's a threshold of diminishing returns above which the athlete's effort is diluted — and recoverability/adaptability are compromised. Fitness and fatigue are a trade-off beyond a certain point. Optimal results are achieved by maximizing effort within a prescribed amount of work.

6. Quality of effort and recovery are interdependent. Workload intensity, frequency and volume are interrelated; and can't be changed arbitrarily. They must be adjusted together, which occurs automatically with a sound plan. The program is only as good as the athletes' ability to recover from and adapt to it!

7. Fitness is a means toward an end, not an end in itself: to develop complementary abilities and skills, and couple effort with execution. Power, flexibility, agility, speed and endurance are the elements of athleticism. Each is trainable, but they must be trained collectively because they are parts of a larger whole. None is a separate entity, nor more important than another. Train athletes, not muscles!

8. Most importantly, skillful athletic movements are the basis of sports training, and require the services of a qualified Strength & Conditioning coach.* If simply counting reps and sets were the answer, anyone could do it. As is the case in all aspects of coaching or teaching, attention must be directed toward what the student-athletes are doing as well as how they're doing it — not just how much they do. Skilled training requires skilled coaching, and without it the program isn't worth the paper it's written on. ■

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