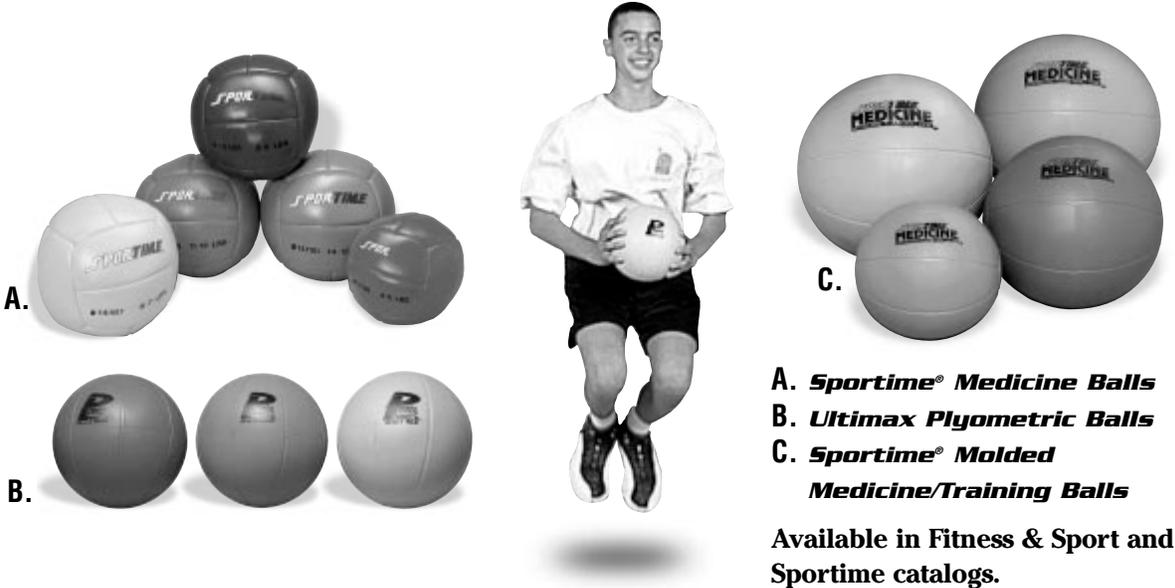


Plyometric Strength Training for the Middle School Student

Created and Written By Joseph E. Herzog



Definitions

Plyometrics: exercises that generate maximum muscle contraction in the shortest possible time.

Power: speed (time) x weight (mass) = power.

Power is the most efficient use of muscular contraction during any physical movement or activity.

Foot Contacts: the number of times contact is made with the ground or mats by one or both feet during a period of exercise or workout.

Blocking: during the process of jumping, begin with arms extended behind the hips and forcefully drive them forward and upward, stopping them at, or just above, head level. If repeated jumps are involved, upon landing the arms must immediately be recovered to the above-described starting position (behind hips). Proper blocking technique promotes maximum application of force to the ground. Application of force to the ground is what initiates virtually all physical motion.

Levels of Intensity

Light: Standing jumps, standing hops

Moderate: Multiple hops and jumps, lunges

High Moderate: Box drills

Intense: Depth jumping

Conditions

This unit was taught to classes that averaged between 33 and 40 students. The environment was a large, well-matted, all-purpose room. The teaching period consisted of 54-minute classes, 5 days a week, with a shorter 32-minute class every other Tuesday. Students dressed in P.E. shirt/short uniforms, or sweats, every day except during the shorter classes. The room had both air conditioning and heating. A single instructor conducted the class.

Intense plyometric exercise is usually completed 3 days per week, with some type of recovery exercise performed on alternate days. Five-day exercise weeks worked well for us, because the time period at each station was relatively short, and in four years we suffered only 1 injury that required missed class time (2 days). These exercises should NEVER be performed on any hard surface. We used brand-new, high-quality mats, usually stacked 2 or 3 high to prevent joint compression injuries. A quality grass surface suffices, though I would restrict or eliminate the use of depth jumping for students of this age (middle school).

A program of the intensity described here is inappropriate for elementary school students, though modifications would be easy. Elementary students should focus on hopping, skipping, jumping, jump rope skills, running, and agility drills (both standing and "scrambling" on their hands). They can also perform medicine ball drills, or use lighter balls to the same effect.

We focused on quality of performance: complete range of motion, blocking, consistency, and concentration on the drill at hand. Of course, the middle school students (grade 7, and some grade 8 students) weren't always perfect. Kids were randomly divided into groups of 6 by drawing.

Equipment

Jump Boxes

Construct your boxes of 1/2" plywood with 30"-square tops. Heights: one @ 10", two @ 12", one @ 14", and one @ 16". They are open on the bottom. Cut a 6" oval slot in the top of each box, though it may suit you better to cut one slot in each of the opposite sides. Seal and paint the boxes. The sides should be white, and the tops painted as follows: 10" green, 12" red, 14" blue and 16" yellow. Commercial boxes are available, but they are relatively expensive. I used both nails and 1-1/4" inch wood screws, and reinforced the corners with metal braces. Mine are very heavy ... a good carpenter can probably make them lighter but just as strong. (Instructions provided by Joe Herzog.)

PVC Hurdles

18"-20" wide, 20 in total number (five @ 6" high, five @ 8" high, five @ 10" high, and five @ 12" high). You may use cones and sticks, tape or string as hurdles, but the PVC hurdles work really well. When we needed something higher than 12", we used cones because we needed only 1 or 2. Each hurdle requires 2 Ts, 2 elbows, a crossbar, four 10" supporting feet and 2 upright posts of appropriate height. I used 1/2" schedule 80 because it is very durable (schedule 40 broke or became brittle over time). I did not glue mine together — while they might come apart when kicked, they are easily reassembled. If they are glued and broken, then repair is a major project! I color-coded the crossbars by height, either with spray paint, colored tape or felt marker.

Portfolios/Heart Rate Charts

Students bring their portfolio to class every day, and perform resting, active and recovery heart rate checks on 90% of active days. Use the carotid artery on a 6-second count, and multiply that number by 10 to arrive at beats per minute.

Boombox/CD Player

You'll want some sort of stereo to play music.

Medicine Balls

3 sets of graduated medicine balls — blue (4 lbs.), yellow (7 lbs.) and red (10 lbs.).

Duct Tape

2 rolls of 2"-wide duct tape.

Weights

2 sets of 5-lb. dumbbells, 2 sets of 10-lb. dumbbells, and one 25-lb. barbell (no weights).

Surgical Tubing

6 lengths of 1/2" surgical tubing. Cut the tubing at 34"-36" so they will be about 28" in length with the handles (1" or 2" in either direction is not crucial). I used torn up T-shirts to make handles, tied on and wrapped with athletic tape at the tie on. Attach the lengths of tubing to a wall ladder at different heights. You can perform many different exercises, and they are great for rehabilitating injuries. These are not formal stations, but they are good for demos and for working with individual kids.

Music

Feel free to choose your own music, but following are my suggestions:

Jazz

I used Dave Brubeck, Miles Davis, and a little Carlos Santana (though he really isn't jazz).

Rock 'N' Roll

Elvis, The Beatles (early), The Beach Boys, 50's Hits, Creedence Clearwater Revival

Classical

Overtures by Franz Von Suppe, the 1812 Overture, Mendelssohn's Italian Symphony, Beethoven's 5th Symphony and the Emperor Concerto. During heart rate recovery periods, Bach's Suite #3, The Air On The G-String, and Pachelbel's Canon in D minor. They are by far the best, though almost any Baroque music or something piano by Mozart works pretty well too.

You may want to develop a music schedule. For example, rock on Monday, jazz on Wednesday and classical on Friday. Then, on Tuesday and Thursday, let the most effective warm-up group select a radio station or CD.

Reference Book

Chu, Donald A. *Jumping Into Plyometrics. Second edition.* Champaign, IL: Human Kinetics, 1998.

Plyometric Exercises and Stations

STEP UPS

Using the 10" box, perform 10 repetitions (reps) leading with the right leg, and 10 leading with the left leg. Emphasize rising up on the ball of the foot. Two kids may use one box at the same time — facing each other, one goes up and, on his/her down phase, the other student starts up. Waiting student should stretch their hamstrings and calves.

JUMP UPS

Using the 12" box, the object is to jump from the floor to the top of the box. First, complete 10 reps of two-foot jumps (jump off two feet and land on both feet). Then complete 5 reps of right-foot jumps and 5 reps of left-foot jumps. Students unable to perform single-foot jumps should continue with two-foot jumps. Teach blocking movements with this exercise, and stress that recovery is as important as the initial block.

DEPTH JUMPING

An exercise for the second half of the unit. Stand on a 16" box, then step off the box and land on the mat with both feet together. At the instant of landing, immediately jump vertically to maximum height (blocking with arms), and land in a "recovered" position. Do not jump up and off of the box ... you'll land with too much force and an instantaneous jump upon landing will not be possible. The last couple of days of the unit, you may want to securely duct tape together a 14" and 16" box and give kids the option of depth jumping off a 30" box. Most kids will be willing to try. You may also try 180-degree and 360-degree turns in the air, which students REALLY enjoy (layer 3 of your best mats for this activity).

AGILITY BOUNDING

For this activity, you'll need a straight line down the floor. You can create a line with a 25-foot length of duct tape placed on a mat, but a chalk line on grass works as well.

- Begin by standing on the left side of the line, on just the right leg. Hop back and forth over the line, progressing down the line to the end. Stretch walk (long stride) coming back. Then repeat on the left leg.
- Begin by standing on the left side of the line, on both feet, with ankles together. Hop back and forth over the line, progressing down the line to the end. Stretch walk (long stride) coming back. Perform this exercise backwards in week two, and maybe add a jump rope in week 3.
- Add a line parallel to the original line, 18" apart. Starting on the far left, hop to the right one line at a time, then back left, and so on. Perform left-leg and right-leg hops ... the same exercises that were completed with the single line.

AGILITY BOUNDING 2

Lay a piece of tape as a starting line. Place another piece about 3 feet away, another at 3-1/2 feet, then 4 feet, etc., out to 7 feet. The object is start at the first piece of tape, measure your jump, and then jump a little further with each effort. Complete both single-leg and double-leg bounds. For younger/smaller kids, simply use a smaller scale (lines closer together) and create fun by calling the areas between lines "canyons" or "rivers" or "boiling lava" or something else along those lines (something they will want to jump over).

CREATURE CRAWLERS

This works best with aerobic steps. Student assumes a push-up position to the right of the step (narrow side of step towards student). The student places his/her left hand up on the step, followed by the right hand. Then the left hand goes down on the floor to the left of the step, followed by the right hand, so the student has moved from the right side of the step to the left side. Now the student should repeat the exercise in reverse, moving back to the right side of the step (lead with the right hand). Most kids struggle with 10 reps in the beginning, so start with 6 reps (but if a student can complete 10 reps right away, turn him/her loose). The first couple of reps should be used to learn the sequence and develop confidence, but after that, let students pick their own level of challenge.

MEDICINE BALL EXERCISES

- **Crunches:** Hold an appropriately weighted ball on the chest and do a set of 20 crunches. You may want to line up the balls, lightest to heaviest, and instruct students to complete 20 reps with the 4-pound ball, 15 reps with the 7-pound ball, and 10 reps with the 10-pound ball.
- **Partners Crunch:** One student stands while the other sits. The standing student underhand tosses a medicine ball to his/her partner, who catches the ball and performs a sit-up, then tosses the ball back to the stander. Repeat the process, completing a number of reps that is appropriate to the strength/skill of the person on the floor.
- **Trunk Lift:** Student lies on stomach, holding ball behind head, and eases his/her torso up off the floor. Emphasize that the student only has to lift his/her body a few inches off the floor — there is no benefit to going higher.
- **Partner Twist:** Sit back-to-back with your partner. One student holds a medicine ball at chest level. Both students turn to the same side, and the ball is passed from one student to the next. Then, the students immediately turn to the other side and the ball is returned. Repeat. Complete 20 reps, or the maximum number of reps possible in 30 seconds.
- **Over/Under:** Students stand back-to-back. Partner 1 passes ball back over his/her head, while partner 2 receives the ball and returns it to partner 1 by passing in between their legs. Perform 10 reps in each direction.
- **Passing Drills:** Perform the same passes you would with a basketball, including two-hand chest, two-hand overhead, right-hand push and left-hand push. Emphasize the principle of opposition.
- **Table Drill:** This is an advanced 3-person drill. Pad the ends of a long cafeteria table with towels or other appropriate padding (adhere the padding with duct tape). **Person #1** stands 4-5 feet back from the end of the table; **person #2** lies on top of the table on his/her stomach with feet towards the middle of the table, torso off the table, and hips BARELY over the end of the table; and **person #3** firmly holds the feet of person #2 on the table. Persons #1 and #2 are on the same end of the table. Person #2, hanging over the end of the table, rises up as in a trunk lift, and person #1 underhand tosses the ball to person #2, who SHOULD catch it over head (you don't need to demand this). After catching the ball, person #2 flexes downward, still holding the ball, then rises up and tosses the ball back to person #1. Repeat 5-10 times. Allow person #2 to catch the ball below head level and toss it back underhand if he/she is not strong enough to make an overhead catch. This is a difficult exercise! As an easier option, kids may simply hold a medicine ball and perform the trunk lifts from the table (you won't need person #1 above to throw the ball, but you'll still want someone to hold the student's feet). In fact, you may want to require kids to start with this exercise before advancing to the more difficult catching drill.

BOUNDING DRILLS

Set up the PVC hurdles — the higher ones slightly closer together than the lower ones — but never closer than 4 feet apart. Start with controlled double-leg hops, focusing on foot positioning (shoulder width), blocking techniques and recovery. Increase speed of the exercise as the students' success warrants.

On single-leg bounding, kids tend to lean to the side of the leg that's being used. As best you can, keep them in an upright position. Kids also tend to start fast and then slow down as they experience trouble controlling their weight when landing. Emphasize the need to start under control and accelerate through the exercise. You may want to mix up the hurdle heights, as a higher first hurdle can slow them down at the start and keep them under control.

For overweight or less-skilled kids who are not confident bounding over hurdles, simply lay out 3-foot green bamboo garden stakes at intervals on the mat and have them perform single-leg and double-leg bounds over them. Concentrate on inclusion ... if a student cannot complete a standard drill, modify the exercise so he/she will achieve success.

BOX DRILLS

On the 10th day or so, start stepping off a box and bounding over the PVC hurdles as a lead-up to box drills. Line up the boxes, tallest to shortest, 4 to 5 feet apart. Step off the first box onto the floor, hop onto the second box, hop down to floor, hop onto the third box, etc. Instruct students to keep their chests and heads up (don't lean too far forward), and to employ good blocking and recovery techniques. Good body positioning is an absolute. As a fun option, allow students to perform 360 degree turns off the final box.

ROPE JUMPING

Students perform basic two-footed jumping, or running in place and jumping. Complete three 15-second intervals (not including preliminary side swings) at maximum speed, with 20 seconds rest between intervals. After completing 3 intervals, rest for one minute, and repeat. Emphasize that students should stay as high on the balls of their feet as possible while jumping.

LUNGING

Standing upright, step forward with right foot until left knee touches the floor. Push back, and recover to standing position. Repeat, but lead with the left foot. Complete a total of 10 reps. Start with no weights, then add a 5-pound weight for each hand, then move up to 10 pounds per hand. You may go as high as 15 pounds with certain kids. Overweight children may not be able to touch the floor with their knees, and you don't want them to injure themselves, so put down small cones and have them touch their knees to the cones until the children develop enough strength to perform a standard lunge. 90% of kids should eventually be able to touch their knees to the floor. Recovery is the most difficult aspect of this exercise.

BARBELL

Pad the bar with a towel, and utilize a spotter.

- **Ankle Pop-Ups:** Students perform ankle pop-ups with the barbell on their shoulders. Their heels should not touch the floor. Choose an appropriate number of reps (10, 15 or 20) per set for the weight/strength of the student.
- **Jump Squats:** Students slightly flex at the knees — nothing beyond 25 or 30 degrees — and jump as high as possible, then recover and repeat. Sets of 10. Once students have developed sufficient balance, they should perform these as quickly as possible.

Observation

To help improve a student's time in the mile run, strengthen their calf muscles and hamstrings, especially if they are overweight. As a cross-country runner, I fully recognize the value and necessity of cardiovascular strength/conditioning, but do not overlook leg strength, which is fundamental to improved running. Kids who run flat footed from start to finish take a lot longer than kids who keep their strides short and the weight primarily on the forward half of the foot, at least when they need to increase speed.

Class Structure

Warm Up:

Heart Rate Terms

RHR: heart rate prior to exercise

AHR: heart rate immediately following exercise

RCHR: heart rate following exercise, after recovery period

Divide the class into groups of six, by random draw. Begin by taking their resting heart rates (RHR). Next, students should run (in my class, then they ran outside, twice around the gym), and then assemble in their groups and begin stretching while roll is taken. While the students sit, briefly review specifics about technique and safety, and ask for questions.

Groups should start at the station where they left off the previous day, and spend 4 minutes at each station. When you stop the music, have everyone complete 15 pushups, then move to the next station. This is a great way to manage time and assure everyone performs at least 60 pushups each day. We usually had 6 groups and 7 stations (sometimes 8), depending on how advanced each class proved to be. After completing two stations, conduct an active heart rate check (AHR).

Closure:

Stop the class with 4 minutes left and instruct everyone to hit the floor, on their backs, with eyes closed for 2-1/2 minutes, while you play something Baroque. At the conclusion, conduct a recovery heart rate check (RCHR). Students should record resting and active heart rates in their portfolios, and write a quick three-sentence summary about the class (what they did well, what was most difficult, what they wanted to accomplish the following day, what they planned for exercise over the weekend, etc.).

Daily Schedule

Foot Touches (Contacts) Per Day

Beginning: 60-100

Progressed: 100-250

Intermediate: 150-300

Advanced: 250-400

Daily Schedule:

Day One:

- Discuss and define unit. Answer questions.
- Warm-Up: Go through exercises as they relate to different stations, specific muscles/groups.
- Activities:
 - Standing 1-foot/2-foot hops and jumps. Jump turns (90, 180, 270 and 360 degrees)
 - Teach principles of blocking and recovery.
 - Divide into randomly drawn groups. Hand out full value contract forms.

Day Two:

- Take RHR and record in portfolios. Run. Warm-up. Take roll. Discuss contracts (due on day 3).
- Question of the day: What is Newton's third law?
- Activities:
 - Standing long jump: Perform 3 consecutive jumps, land and recover.
 - Right leg hop (3 reps), left leg hop (3 reps). All students at one time. Take AHR.
 - Step-up on boxes (2 sets of 10 reps). Hop-up on boxes (2 sets of 10 reps).
 - Answer question of day.
 - Answer questions about the contract. Quiet time. Music. Take/record RCHR. Do "quick write" (write a brief daily summary) in portfolios.

Day Three:

- Take/record RHR. Warm-up. Collect contracts.
- Activities:
 - Bounding over PVC hurdles or sticks (10 reps).
 - Single-line agility (right leg and left leg).
 - Take AHR
 - Creature Crawlers (10 reps).
 - Quiet time. Music. Take/record RCHR. Quick writes. Answer questions.

Day Four:

- Take/record RHR. Warm-up. Collect contracts.
- Activities:
 - Medicine ball drills: Crunches without partner, crunches with partner, trunk lift with ball, partner twist (10 reps), over/under drill (10 reps).
 - Lunges (5 right, 5 left).
 - Take/record AHR.
 - Vertical jump test.
 - Quiet time. Music. Take/record RCHR. Quick writes. Answer questions.

Days 5-7:

- Take/record RHR. Warm-up. Explain rotation system. Assign groups to stations and conduct walk through with pushups between.
- Stations:
 1. Step-ups
 2. Hurdles/hopping/bounding
 3. Creature Crawlers
 4. Medicine ball crunches
 5. Single-line agility
 6. Lunges
 7. Jumping rope
 8. Add to station one: Jump-ups on boxes

Days 8-9:

- Add to station 2: Box step off and bound.
- Add to station 4: Table drills.

Days 10-11:

- Add to station 2: Multiple in-line boxes for bounding.

Day 12:

- Assess by groups: Bounding over PVC hurdles (blocking technique & body position).

Days 13-15:

- Add depth jumping off of double box.

Days 16-18:

- Add 180-degree and 360-degree turns to box drills.
- Discussion: On days 20 and 21, three randomly drawn groups will be videotaped.
 - Students will have 1 minute to explain the exercise station and the muscles being worked.
 - Name 3 physical activities superficially affected.

Day 19:

- Groups practice at selected stations for videotaping. Prepare written scripts if desired.

Days 20-21:

- RHR, warm-up.
- Select 3 groups by random, each day, to videotape a presentation about a station. Return to regular rotation after taping

Day 22:

- Students complete peer-evaluations and self-evaluations. Return to regular rotation.

Day 23:

- Vertical jump re-test.
- Turn in portfolios for evaluation of heart rate charts and quick writes.

Day 24:

- Return portfolios to students.
- Return to regular rotation.

Day 25:

- Transition to next unit.

Standards To Meet**ONE: Student demonstrates competency in many movement forms, and proficiency in a few.**

Forms of movement to be demonstrated include bounding, skipping, hopping, lateral movement, forward and backward, lunging, pushing, pulling, controlled throwing and leaping. Students must choose a specific exercise in which to demonstrate proficiency.

TWO: Student applies movement concepts/principles and the learning and development of motor skills.

Students apply bounding, skipping, hopping and agility to a wide variety of specific exercises.

THREE: Students develop physically active lifestyles.

Students are physically active for 30-35 minutes per day.

Students are required to design their own warm-up routines in relation to their exercise programs.

Students show improved scores in crunches, pushups and 1-mile run, based on their pre-test scores and in comparison to students who did not engage in the plyometrics class.

FOUR: Through participation, students understand that physical activity provides opportunities for enjoyment, challenge and self-expression.

Students recognize the importance of designing programs that fit their own needs and challenge them to reach higher standards.

Students use “quick writes” (daily written summaries) to express their needs, feelings, goals and plans to include physical activity in their lives.

Students explain a specific exercise, and demonstrate the drill on videotape.

FIVE: Students demonstrate responsible personal and social behavior in physical activity settings.

All students participate in the construction of a full value class behavior contract.

Students are required to meet challenges and participate in low-level risk taking activities.

SIX: Students understand the relationship between history and culture and games, sports, dance and play.

Development of plyometrics and their relation to improved physical performance, and their historical development in Eastern Europe and the Soviet Union.

SEVEN: Students understand the importance of respect for others through responsible social behavior while participating in movement activities.

Students work cooperatively with partners and in small groups.

Students participate in the construction of class standards through the full value contract.

Students use T scales, videotapes, self-evaluations and peer evaluations.

The “Plyometric Strength Training for Middle School Students” unit takes a lot of preparation. It may take some time to find the right setup for stations in the room. In a 40' x 60' room, running east and west, I suggest creature crawlers, jump rope and table drills at the west end of the room; lunges at the east end of the room; line agility activity running east to west on the south side of the room; line of medicine balls running down the center; and the hurdles and boxes running east to west in the north half of the room. The set up of the room will change every couple of days as activities are added/modified. Activities should move quickly enough that kids rarely wait in line for more than 15 seconds or so. Students should stretch or practice blocking skills while waiting.

I hope that this activity guide will generate some questions and interest. Please don't hesitate to get a hold of me. If you can improve the quality of this, or correct any errors, don't hesitate! I'm still learning, and proud of it!

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