

Guidelines for Implementing a **Dynamic** Warm-up for Physical Education

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As doubts about the value of static stretching grow, dynamic exercise offers a more beneficial warm-up procedure.

It is important for all students to warm up before participating in the main activities of a physical education class. A general warm-up of low-intensity aerobic activity such as walking or jogging, followed by static stretching, is typically used to prepare students' cardiovascular and musculoskeletal systems for more vigorous physical activity (Martens, 2004; Virgilio, 1997). Since this type of warm-up can increase blood flow to active muscles, raise body temperature, and improve range of motion within the joints, it is widely believed that children and adolescents who engage in it will enhance physical performance and reduce the risk of muscular injury (Holcomb, 2000; Martens, 2004). The National Association for Sport and Physical Education (NASPE) recognizes the importance of a general warm-up, and recommends five to ten minutes of a cardiovascular warm-up activity followed by static stretching (NASPE, 2005).

While flexibility is a well-recognized component of health-related fitness (NASPE, 2005), long-held beliefs regarding the routine practice of pre-event static stretching have been questioned (Knudsen, 1999; Schier, 2004; Thacker, Gilchrist, Stroup, & Kimsey, 2004). Several studies on adults have indicated that an acute bout of static stretching can have a negative influence on strength and power performance (Cornwell, Nelson, Heise, & Sidaway, 2001; Kokkonen, Nelson, & Cornwell, 1998; Young & Elliot, 2001). In addition, it now appears that static stretching immediately before exercise has no significant effect on injury prevention (Shrier, 2005; Thacker et al.).

Similar effects of static stretching on anaerobic performance have recently been observed in children. For example, Faigenbaum, Bellucci, Bernieri, Bakker, and Hoorens (2005) reported a significant decrease in jumping performance and sprint speed in children following an acute bout of static stretching. McNeal and Sands (2003) and Siatras, Papadopoulos, Mameletzi, Gerodimos, and Kellis (2003) also observed that static stretching had a negative effect on explosive force and speed development in boys and girls. In support of these observations, Faigenbaum et al (2006) reported that pre-event static stretching followed by dynamic exercise was more beneficial than static stretching alone in teenage athletes who performed power activities. Collectively, these findings suggest that warm-up protocols that include only static stretching may have unintended adverse consequences on anaerobic performance in children. Indeed, the President's Council for Physical Fitness and Sports reported that static stretching might compromise performance (Knudson, 2000).

Since the current practice of pre-event static stretching has been based more on intuition than scientific evidence, teachers, coaches, and researchers have become interested

Table 1. Sample Dynamic Warm-up Exercises



1

1. Low Jacks: While moving feet apart and together, lift arms from hips to shoulder level. Progress to high jacks by lifting arms from shoulder level to overhead.



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2. High-Knee March: While marching in place, lift right knee towards left elbow then return to starting position and repeat on opposite side. Drive with a high knee lift and bring opposite elbow towards knee. Progress to a high-knee walking march by performing this drill while marching forward.



3

3. Standing Flutter: Stand with both arms extended above head and feet at shoulder width. Extend left arm and right leg backwards a few inches while maintaining an erect body position. Return to starting position and perform with opposite limbs. Keep arms and legs extended during the movement. Progress to a continuous and repetitive flutter performed with full extension of all limbs.



4

4. Standing Toe Touches: Stand with both arms extended in front of the body. Lift one extended leg towards the extended arms and then return to starting position. Alternate movement with other leg and repeat. Progress to a walking standing toe touch by performing this drill while moving forward.



5

5. Stepping Trunk Turns: With hands clasped behind head, march in place and turn hips to the right 90 degrees then the left 90 degrees while upper body remains forward. Progress to trunk rotations by placing both hands behind your head and then hop forward as you turn your hips to the right then the left. Focus on trunk rotation and an erect body position during both movements.



6

in warm-up procedures that involve the performance of dynamic movements designed to elevate core body temperature, enhance motor unit excitability, improve kinesthetic awareness, and maximize active ranges of motion (Cissik & Barnes, 2004; Rutledge & Faccioni, 2001). This type of pre-event protocol is called “dynamic exercise,” and it typically includes low-, moderate-, and high-intensity hops, skips, jumps, lunges, and various other exercises for the upper and lower body.

During a dynamic exercise, the muscles are stretched to a new range of motion and then forced to contract to perform the desired action. Since muscles are actually used in a new range of motion, it is logical to assume that they will be better prepared for the main activities of physical education class. It is important to understand that a dynamic stretch does not involve a bouncing-type movement, which is characteristic of a ballistic stretch, but rather a controlled elongation of a specific muscle group. Since dynamic exercises actually prepare the body for movement during physical activity, the term “movement preparation” is also used to describe this type of warm-up (Verstegen & Marcello, 2001).

Dynamic Motivation

Getting students ready for physical education class is not just about low-intensity aerobic exercise and static stretching. A well-designed warm-up can set the tone for the class and establish a desired tempo for the upcoming activities. If a warm-up is slow and monotonous, then performance during the main physical activities that follow may be less than expected. However, if the warm-up is brisk, exciting, and diverse, our observations suggest that performance during the physical education lessons will likely meet or exceed expectations. In short, a dynamic warm-up satisfies the need for students to move when they enter the gymnasium and helps to focus their attention on listening and learning.

During our warm-up sessions, we want our students to do more than increase their body temperature. We want to turn on their neuromuscular systems, improve mobility, enhance flexibility, and properly prepare them for the main activity portion of the physical education lesson. We refer to this sequence as “warm up, turn on, and work out.” “Warm up” refers to exercises that prepare the students for the physical education lesson. Instead of three laps around the gym,

6. Crunches: Begin by lying on ground with knees bent at 90 degrees, feet flat on the ground, and arms crossed on chest. Crunch upward, aiming the elbows toward the thighs. Progress to crunch punches by increasing the velocity of the crunch action while pushing both arms from a chest crossed position to an extended arm position above the knee. Emphasize a slow controlled return to starting position for safety and proper technique.

7. Marching Lateral Shuffle: From a standing side-stance with feet at hip width, hop and land with feet at shoulder width and body lowered to a semi-squat position. While maintaining this position, move laterally by taking a lead step followed by a short secondary step. Progress to a quick lateral shuffle by increasing the speed of the lateral movement.

8. High-Knee Skips: Rapidly skip forward while focusing on knee lift, arm action, and reduced ground time. To progress to kick away, jog forward while kicking heels backward with extended leg. Emphasize proper form by allowing the knee to bend at the end of the kick away to assist the return of the foot to the ground quickly.

9. Partial Push-ups: From a standard push-up position, lower body until elbows are at 90 degrees, then return to the starting position. Progress to push-up and lift one hand a few inches off the floor after returning to the starting position. Maintain a three-point base of support for a few seconds, then return hand to starting position and repeat on opposite side.

10. Run and Go: From a standing position, lean forward as you run to the five-yard mark and then sprint through the 10-yard mark. Focus on arm action, knee height, and accelerating as fast as possible. Progress to run and stop leaning forward as you sprint through the five-yard mark and then stop at the 10-yard mark. Focus on decelerating by lowering your body, bending your knees, and increasing foot contacts (i.e., chop feet several times).



we use a variety of dynamic activities that require balance, agility, coordination, flexibility, strength, and power. “Turn on” refers to the activation of the neuromuscular system to excite the proper muscles. Since most students have been sitting in class before physical education, their muscles need to be “turned on” for the main activity component of the lesson. This is accomplished by performing low-, moderate-, and high-intensity dynamic movements. “Work out” refers to the conditioning aspect of our warm-up protocols, which can result in meaningful improvements in fundamental movement skills and fitness performance. Unlike static stretching, a dynamic warm-up prepares the body for the more vigorous, random movements that occur during some physical education lessons.

A fundamental principle of our dynamic warm-up protocol is that our warm-up exercises are similar in design and function to the activities that the students will be performing in the main activity segment of our physical education classes. While we recognize the value of traditional stretch-and-hold exercises, we incorporate static stretching exercises into the cool-down of our physical education class rather

than the warm-up. Remember that the goal of traditional stretching is to relax the muscles whereas the goal of a dynamic warm-up is to activate them. During the performance of a dynamic exercise, not only do muscles lengthen (as they do in a static stretch), but they contract and move within a new range of motion. This type of movement-based training can enhance muscle strength, improve posture, develop kinesthetic awareness, and maximize active ranges of motion. In addition, warm-up activities that are active, engaging, and challenging, and that provide an opportunity for children to gain confidence in their ability to perform fundamental movement skills, are far more enjoyable than traditional stretch-and-hold activities, which some students in our classes find boring.

Dynamic warm-up protocols may also offer cardiovascular benefits. In one study, we found that the average heart rate (measured by portable heart-rate monitors) during a traditional warm-up (low-intensity aerobic exercise and static stretching) averaged 109 beats per minute, whereas a dynamic warm-up protocol elicited an average heart rate of about 150 beats per minute (Faigenbaum et al., 2005).

These findings suggest that warm-up protocols that include dynamic exercise may increase the amount of time children engage in moderate-to-vigorous physical activity, which is an important public health objective (National Institute of Child Health and Development, 2003).

Developing a Dynamic Warm-up

Our dynamic warm-up routines do not require equipment or a lot of space. Students perform each functionally based movement for about 10 yards, rest a few seconds, and then repeat the same movement as they return to the starting position. Students generally perform eight to 12 different exercises that progress from relatively simple movements to more challenging exercises involving more complex movement patterns. After we demonstrate each exercise, students perform them as we provide instruction to maintain proper form (e.g., vertical torso, knees towards chest, up on toes). Our physical education classes use a seamless transition from a five-to-ten-minute dynamic warm-up to the start of the main physical activity lesson.

Table 1 describes a progressive, dynamic, warm-up routine that we use for school children in our physical education classes. Since there are literally hundreds of exercises that can be incorporated into a dynamic warm-up, the sample exercises should be used as a starting point or guide to help physical educators develop a routine that is consistent with the needs and abilities of each student. Although a dynamic warm-up may feel like a workout, remember that its goal is to prepare students for the main activity segment of class without undue fatigue. Additional ideas for developing dynamic warm-up protocols for physical education class and sports practice are available elsewhere (Chu, Faigenbaum, & Falkel, 2006; Mediate & Faigenbaum, 2004).

Summary

A dynamic warm-up routine can add a new, exciting, engaging, and beneficial dimension to a physical education class. By gradually progressing from simple to more complex movements, students will gain confidence in their abilities while getting ready for the main activities of physical education. Additional research on the acute and chronic effects of dynamic exercise on youth will help physical education teachers optimize warm-up procedures for students.

References

- Chu, D., Faigenbaum, A., Falkel, J. (2006). *Progressive plyometrics for kids*. Champaign, IL: Human Kinetics.
- Cissik, J., & Barnes, M. (2004). *Sport speed and agility*. Monterey, CA: Healthy Learning.
- Cornwell, A., Nelson A., Heise G., & Sidaway, B. (2001). Acute effects of passive muscle stretching on vertical jump performance. *Journal of Human Movement Studies*, 40, 307-324.
- Faigenbaum, A., Bellucci, M., Bernieri, A., Bakker, B., & Hoorens, K. (2005). Effects of different warm-up protocols on fitness performance in children. *Journal of Strength and Conditioning Research*, 19, 376-381.
- Faigenbaum, A., Kang, K., McFarland, J., Bloom, J., Magnatta, J., Ratamess, N., & Hoffman, J. (2006). Acute effects of different warm-up protocols on anaerobic performance in teenage athletes. *Pediatric Exercise Science*, 17, 64-75.
- Holcomb, W. R. (2000). Stretching and warm-up. In T. R. Baechle and R. W. Earle, (Eds.), *Essentials of strength training and conditioning* (pp. 321-342). Champaign, IL: Human Kinetics.
- Knudson, D. (1999). Stretching during warm-up: Do we have enough evidence? *Journal of Physical Education, Recreation & Dance*, 70(7), 24-51.
- Knudson, D. (2000). Current issues in flexibility fitness. *Presidents Council on Physical Fitness and Sports Research Digest*, 3, 1-6.
- Kokkonen, J., Nelson, A., & Cornwell, A. (1998). Acute muscle stretching inhibits maximal strength performance. *Research Quarterly for Exercise and Sport*, 69, 411-415.
- Martens, R. (2004). *Successful coaching* (3rd ed.). Champaign, IL: Human Kinetics.
- McNeal, J., & Sands, W. (2003). Acute static stretching reduces lower extremity power in trained children. *Pediatric Exercise Science*, 15, 139-145.
- Mediate, P., & Faigenbaum, A. (2004). *Medicine ball for all*. Monterey, CA: Healthy Learning.
- National Association for Sports and Physical Education. (2005). *Physical education for lifelong fitness: The Physical Best teacher's guide* (2nd ed.). Reston VA: Author.
- National Institute of Child Health and Development. (2003). Frequency and intensity of activity of third-grade children in physical education. *Archives of Pediatrics & Adolescent Medicine*, 157, 185-190.
- Rutledge, I., & Faccioni, A. (2001). Dynamic warm-ups. *Sports Coach*, 24, 20-2.
- Shrier, I. (2004). Does stretching improve performance? *Clinical Journal of Sports Medicine*, 14(5), 267-273.
- Shrier, I. (2005). When and whom to stretch? *Physicians and Sports Medicine*, 33(3), 22-26.
- Siatras, T., Papadopoulos, G., Mameletzi, D., Gerodimos, V., & Kellis, S. (2003). Static and dynamic acute stretching effect on gymnasts' speed in vaulting. *Pediatric Exercise Science*, 15, 383-391.
- Thacker, S., Gilchrist, J., Stroup, D., & Kimsey, C. (2004). The impact of stretching on sports injury risk: A systematic review of the literature. *Medicine & Science in Sports & Exercise*, 36, 371-378.
- Young, W., & Elliot, S. (2001). Acute effects of static stretching, proprioceptive neuromuscular facilitation stretching, and maximal voluntary contractions on explosive force production and jumping performance. *Research Quarterly for Exercise and Sport*, 72, 273-279.
- Verstegen, M., & Marcello, B. (2001). Agility and coordination. In B. Foran (Ed.), *High performance sports conditioning* (pp. 139-166). Champaign, IL: Human Kinetics.
- Virgilio, S. (1997). *Fitness education for children*. Champaign, IL: Human Kinetics.

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