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LET'S GET PHYSICAL



-  exercise performance, fitness, enhancement, measurement
-  physical education, physics, biology, mathematics, computer science
-  all age levels
-  football, medicine ball (2 kg), stopwatch, measuring tape, three adjustable hurdles, five poles, chalk, dark wall or gym mat (2 m × 4 m)

1 | SUMMARY

In this unit we present a series of exercise performance tests that apply to different aspects of football. Students should then devise an exercise programme that enhances their exercise performance. A student training diary is provided to enable them to monitor and discuss their progress.

2 | CONCEPTUAL INTRODUCTION

2 | 1 Aims

Physical fitness and exercise are not only essential for football players; they also provide several health benefits.

2 | 2 Background information

The ability to exercise a football skill is dependent on several factors. These factors must combine in the player to produce a high-quality performance. Several lists of such factors exist (e.g. Davis, B. et al. (2000) Training for physical fitness; Tancred, B. (1995) Key Methods of Sports Conditioning). All of them include a certain level of fitness and strength, a certain level of balance and a mental commitment to the task. It is worth considering these lists. Ignoring any one factor can severely inhibit overall performance. If we take commitment to the task as a given, we can divide the ability to perform well into “skill” and “fitness”. In simple terms, skill can be improved through practice and fitness through exercise. The combination of improvement in these two factors will result in a measurable improvement of performance. Each task should be seen as one that, if developed, will improve overall performance in the sport. These broad divisions can be subdivided, for there are a number of different types of skills:

- Cognitive – intellectual skills that require thought processes
- Perceptual – interpretation of presented information
- Motor – movement and muscle control
- Perceptual motor – involving thought, interpretation and movement skills

The skills associated with football that are part of this experiment will mostly be motor skills. The measure of fitness is associated with the numerous muscles of the body and their strength, suppleness and endurance. Different tasks require different muscles to function efficiently, whether this involves the leg muscles, core strength or upper body strength. In the different exercises that are suggested, we can say we are targeting one particular set of muscles but also various components of fitness.

- Test 1 · Slalom: will test the athlete’s coordination as well as strength in the leg muscles.
- Test 2 · Vertical jump test: jumping to head a ball will test the athlete’s coordination as well as strength in the core and leg muscles.
- Test 3 · Overhead medicine ball throw: will test the athlete’s power, coordination, balance and strength in the upper body.
- Test 4 · Hurdles boomerang run: will test the athlete’s movement coordination, balance and leg strength.
- Test 5 · Cooper test: will test the athlete’s fitness level and endurance capacity.

2 | 3 Interdisciplinary possibilities

This project can enable interdisciplinary collaboration in the subjects of biology (e.g. heart rate, breathing rate, muscles), physics (e.g. acceleration, velocity, measurements), physical education (background information about training), mathematics and computer science (e.g. statistics, graphs, correlations).

2 | 4 Precautions

Even though exercise performance tests are non-invasive, please ensure that the safety and health rules for your institute/school are adhered to. All exercise performance tests and follow-up training sessions should be within the capabilities of the students. Warming up before the exercise performance test and the training sessions is essential.

3 | WHAT THE STUDENTS DO

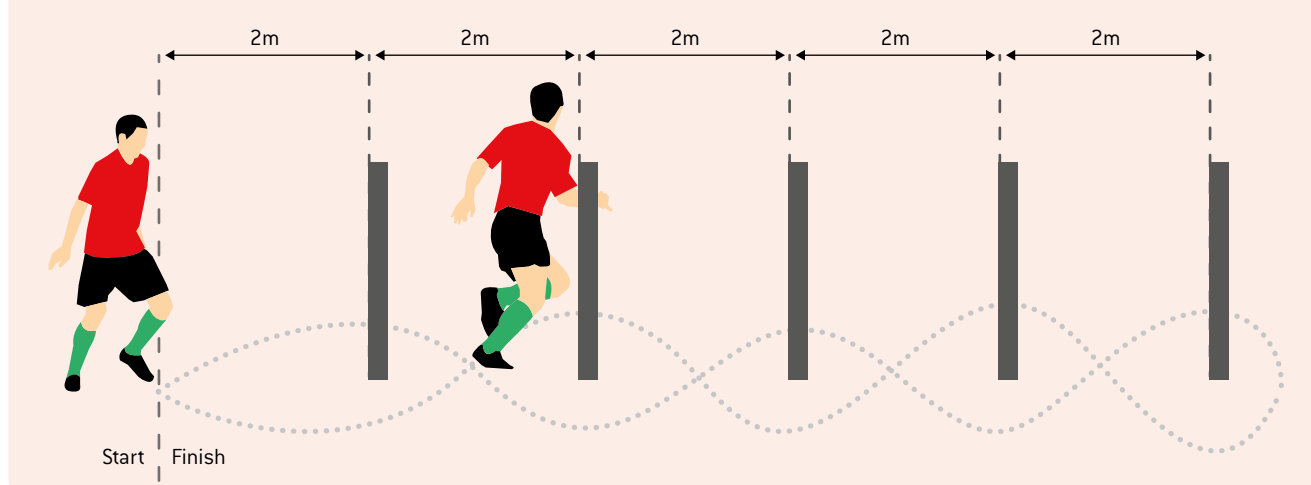
The students need to perform five different exercise performance tests at different times. The follow-up training period should enhance exercise performance, which is tested in a second exercise performance test at the end of the training period. The appropriate training methods have to be selected individually. Constructive suggestions corresponding to the training schedule can be provided by each teacher. The individual training sessions should extend over a minimum of three and a maximum of six weeks. The students should be encouraged to develop their own exercise regimens. Suggestions are given for teachers in the additional material ^[1]. The training programme can include both targeted exercises and physical activities (e.g. cycling, running, etc.). In addition, the training needs to be documented in the training diary.

The number and frequency of the follow-up exercise performance tests can be individually regulated but must be arranged with the respective teacher. The exercise performance tests must be performed as shown below, although this order is not mandatory.

3 | 1 First skill: acceleration and speed—slalom

- **Equipment needed:** five poles, measuring tape, a stopwatch and a football
- **Setup:** Define the start and finish zones. Set five poles in a straight row with two metres between each one. For time-keeping use a stopwatch or ideally a light barrier control.

FIG. 1 Slalom test



- **Test A:** Run in a slalom pattern between the sticks, turn at the last pole and run back to the finish line in the same way (FIG. 1). Measure the time as accurately as possible and record it.
- **Test B:** Repeat test A while dribbling a ball. Focus on keeping the ball close to you and under control. Record the time required.
- Perform three trials each and highlight the best one. If a pole falls over or the slalom is not properly completed, the attempt does not count.

3|2 **Second skill: vertical jumping power and strength—vertical jump test**

- **Equipment needed:** dark wall or gym mat (2 m × 4 m) and, if available, alternative measuring equipment, chalk, measuring tape and a stepladder
- **Setup:** There are several common methods of measuring vertical jumping height. Please check the available measuring equipment (e.g. force plate, video systems, “Vertec” etc.). However, the simplest method is to measure the jump against a dark wall (e.g. with dark paper affixed to the wall) or a thick gym mat (recommended height approx. 4 m). If you are using a mat, lean it against the wall and make sure it does not fall over. Additional equipment includes chalk, a measuring tape and, if required, a stepladder.
- **Test:** Start by standing beside the mat. Use the chalk to mark your finger on the hand closest to the wall. Then reach up as high as possible and mark this height on the mat or the wall. Please note that both feet need to be on the ground! Now mark your finger again, stand slightly away from the wall and jump as high as possible, using both arms and legs to assist. Attempt to touch the mat or the wall at the highest point of the jump. Measure the distance between the standing reach height and the maximum jump height, and that is your result. Perform three trials each and highlight the best one.

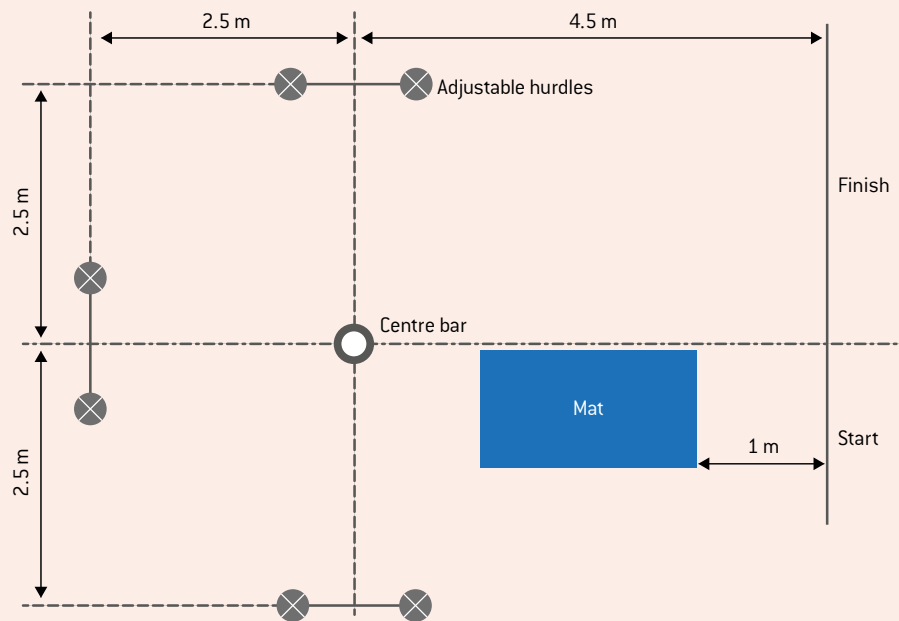
3|3 **Third skill: upper limb core strength and explosive power—overhead medicine ball throw**

- **Equipment needed:** medicine ball (2 kg) and measuring tape
- **Setup:** Choose an appropriate room that permits long and high-distance throws. When performing outdoor tests, be aware of wind conditions that could influence the test results. Define a starting line and place distance marks to simplify the measurement of the throwing distance.
- **Test:** Stand at the starting line and face the direction in which the ball is to be thrown. Your feet must be positioned side by side and slightly apart. Hold the ball in both hands at the sides and slightly behind the centre. Bring the ball back behind your head and bend your knees slightly. Then vigorously throw the ball forward as far as possible while performing an up-and-forward motion. You are permitted to step over the starting line after the ball is released. Taking a run-up to enhance the throw distance is prohibited. Perform three trials; only the best trial will count.

3|4 **Fourth skill: movement coordination agility and acceleration—hurdles boomerang run**

- **Equipment needed:** central pole, a mat, adjustable hurdles (plug hurdles, exercise hurdles), tape measure and a stopwatch or a light barrier control
- **Setup:** Set up the testing area as illustrated in FIG. 2.
- **Test:** Before starting the test, adjust the hurdles according to the individual's body height—compare FIG. 3. In order to avoid frequent adjustments of the hurdles, it is recommended to group the students according to height. Have the individuals run the course anticlockwise as fast as possible. If the central pole or one of the hurdles falls over, the attempt does not count. Stand in an upright position at the starting line. Begin the test with a forward roll on the mat. Make a quarter-turn around the central pole, jump over a hurdle and immediately return and crawl beneath it. Run back to the central pole, make another quarter-turn and take the next hurdle. Thereafter, run back to the central pole, make a quarter-turn and jump across/crawl beneath the third hurdle.

FIG. 2 Hurdles boomerang run



Run back to the central pole, perform a last quarter-turn and cross the finish line.

FIG. 3 Appropriate hurdle height for body heights

Body height [cm]	Height of hurdles [cm]
121 – 125	50
126 – 130	52
131 – 135	54 etc.

3 | 5 Fifth skill: physical fitness and endurance capacity—Cooper test

- **Equipment needed:** flat running track (e.g. 400 m tartan track or similar) and a stopwatch
- **Setup:** No special measurement arrangement is required.
- **Test:** The students should run as far as possible in 12 minutes. Begin the test after sounding a starting signal. After 12 minutes have elapsed, the assistant sounds a signal and the completed distance is recorded.

4 | CONCLUSION

In this unit we have provided a series of suggestions regarding motivational exercises related to the skills used in football. Through these activities, students at all levels of ability may experience an improvement of their measured performance. The suggestions are applicable to both boys and girls. Scientific skills are also developed through the process of making measurements, devising and recording training programmes, and interpreting the results.

The key is the motivation of students. This can be achieved as the teachers monitor the students' progress through the programme, and also as students actually experience their own

achievement of skills. Our experience is that if the programme is applied, even the weakest student will be able to see improvement, and those who are more able will be inspired through their own increased levels of performance.

5 | COOPERATION OPTIONS

Since many schools will participate in this project, Science on Stage provides a list of the schools and contact details. Please check out the iStage homepage ^[1].

Data could be used for displays, to enhance motivation, as real data for statistical analysis and to reward improvement and achievement. Comparisons can be made, e.g., between regular players, genders, ages, etc.

REFERENCES

- ^[1] All additional materials can be found at www.science-on-stage.de/iStage3_materials.



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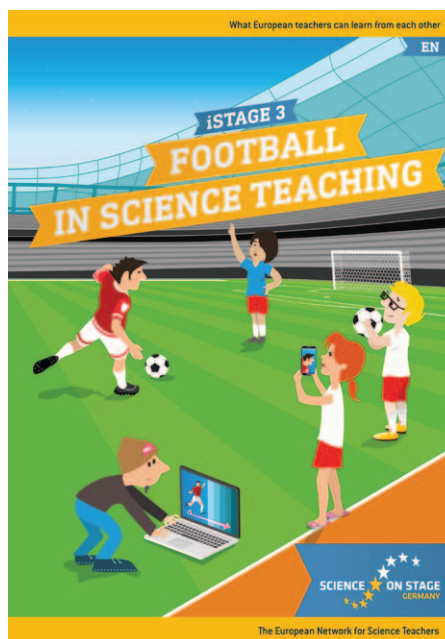
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