

ISSP POSITION STAND: TO TEST OR NOT TO TEST? THE USE OF PHYSICAL SKILL TESTS IN TALENT DETECTION AND IN EARLY PHASES OF SPORT DEVELOPMENT

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ABSTRACT

A Searching for talent and the assessing ability in young prospects from individual and team sports often include measurement, analysis, and evaluation of physical and motor skills. The use of these tests in early stages of talent development has been widely observed in both female and male prospects. The purpose of this paper is to review a series of studies conducted on talented and less-talented athletes/players that were aimed at distinguishing between the two groups and at predicting the athletes'/players' future achievements/success. Thirteen studies examining the use of physical and motor skill tests in young prospects are reviewed. Based on this review, four main observations are highlighted and a number of benefits and limitations associated with the use of such tests are discussed. It is recommended that (1) coaches reduce the number of batteries of physical and motor skill tests used in early phases of talent development and (2) coaches and sport scientists specializing in measurement and evaluation cooperate in order to improve the effectiveness of the application and interpretation of physical skill tests given to prospects at early stages of talent development.

Keywords: Talent detection, early development, physical skill tests, individual sports, team sports, action situations.

Searching for talent and assessing early development are valuable stages in almost any multi-step sport program (Brown, 2001; Falk, Lidor, Lander, & Lang, 2004; Williams & Reilly, 2000). These stages usually include three aspects of measurement and assessment: physical, psychological, and sociological (Brown, 2001; Fisher & Borms, 1990; Reilly, Williams, Nevill, & Franks, 2000). If measured correctly, these elements may provide coaches and physical educators with relevant information on the young prospects' abilities.

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When examining the context of the tests used by coaches and instructors in searching for talent in young athletes and in the evaluation of early developmental stages of talent, it becomes obvious that, although there are a variety of tests assessing the physical ability and motor skill level of young prospects, only a few examine the psychological and sociological aspects (Abbott & Collins, 2004; Brown, 2001; Gore, 2000; Malina, Bouchard, & Bar-Or, 2004; Morris, 2000; Morrow, Jackson, Disch, & Mood, 2005). Among the objectives of tests assessing the physical ability and skill level of young athletes are (a) determining their physical abilities and motor skill level across different phases of the training program—preparation, competition, and transition (Falk et al., 2004; Reilly et al., 2000), (b) predicting the athletes' potential and future success (Lidor, Falk et al., 2005; Spamer & Coetzee, 2002), and (c) motivating them to practice harder and improve their individual physical achievements (Morrow et al., 2005).

A few relevant factors should be considered by coaches when using tests that assess the physical ability and skill level of prospects in early phases of talent development. From an action theory perspective, these factors refer to the components of an action situation: the person, the task, and the environment (Hackfort, 2006). With regard to the prospect, coaches should take into account the athlete's multi-faceted developmental stage. Some of the children who are involved in sport activities at an early age are mature enough biologically and psychologically to perform the tests assessing physical ability and skill level and to attain a high level of achievement. However, others may not have reached the required maturation levels that would enable them to cope with the challenge, as well as the specific requirements of the tests, and thus, they will not be able to succeed. Some of the prospects may be accelerated in their physical development and highly motivated to perform, while others might say they perform "just because someone asked me to do it." The social preconditions of the prospects should be taken into account as well. Some of the children may have a supportive social environment (e.g., peer group, parents, or teachers) encouraging them to be physically active, and this would enable them to achieve a certain level of athletic performance (Burrmann, Stucke, & Streso, 2007).

Coaches should also take into consideration the characteristics and features of the tasks included in the battery of tests. A variety of tests are composed of tasks reflecting fundamental motor abilities such as catching, jumping, running, and throwing, which are familiar to children from an early age and, thus, can be successfully performed by the prospects. However, there are sport tasks that are artificial in nature with which the prospects may not be familiar, such as passing in volleyball, and subsequently, they may experience difficulty executing them.

The type of sport is also a factor that should be considered by the coach in the testing process. For example, if the test assesses abilities/skills required in team sports (e.g., basketball or soccer), then it should be composed of both individual and group activities; if the test assesses abilities/skills needed in individual sports (e.g., gymnastics or track and field), the prospect would probably perform the task individually. It is assumed that it would be easier for the coach to use a test that assesses abilities/skills in individual sports rather than team sports in this case.

According to the theoretical foundations of the action theory approach (Hackfort, 2006), it is especially important to consider that human actions are based on the dynamic interrelationships of the person, the task performed, and the environment in which this task is performed. Therefore, when coaches select a test assessing the prospect's physical ability and skill level, they should be aware of the interrelationships that exist among the prospects (i.e., their biological and cognitive developmental stages), the tasks they perform (e.g., familiar/artificial, level of difficulty), and the environment (e.g., individual/team sports, the specific settings in which the test is performed). In order to meet the objectives of the tests, and particularly their predictability effect, all these factors must be taken into account, and a careful selection of tests assessing physical ability and motor skill level should be made. A question that coaches often ask is whether these tests will be effective enough to help them make appropriate decisions associated with the future success of their talented prospects. Therefore, it must be assessed whether coaches (and their athletes) can really benefit from the use of tests assessing physical ability and skill level in early phases of the talent search and early development in sport.

Furthermore, the specific criteria coaches consider should be carefully discussed. For example, is it more beneficial to refer to a high physical/motor criterion (e.g., a high score in the test) or a low psychological criterion (e.g., a low score in motivation or aspiration) when searching for the talented prospect? Or, would it be better to refer to low criteria with respect to the outcome of the tests assessing physical ability and skill level and give a high emphasis to the prospect's psychological characteristics, such as intrinsic motivation and task orientation, which are associated with the given test?

The use of tests assessing physical ability and motor skill level can be also discussed from a philosophical point of view. On the one hand, there is the claim that talent is determined by human genes and designated tests should be able to detect one specific talent. On the other hand, there is the view that every child has various potential talents, and each of these children has the potential for successful development. In both cases the consequence is that talent has to be promoted by appropriate tasks (i.e., tests) at the right point in time, and the young prospect must be provided with the necessary environmental support. However, the functional meaning of the tests as well as of the testing process is varied, and it has to be decided for what specific objectives (e.g., detecting a talent or creating one) the designated tests are used.

The purpose of this paper is threefold: (1) to discuss the data that emerged from a series of studies examining the use of tests assessing physical ability and skill level of talented and less-talented individuals in early phases of talent detection and the athletes' development in sport; (2) to make a number of observations based on the review of relevant empirical studies and outline some benefits and limitations associated with the use of the tests assessing physical ability and motor skill level; and (3) to justify our recommendation that coaches should reduce the use of batteries of tests assessing physical ability and motor skill level in early phases of sport development.

This paper is composed of six parts. The first briefly discusses various global approaches to talent detection and early development in sport. The second provides a

broad definition of the term physical skill test. The third reviews data from a series of studies examining the use of physical skill tests in early phases of talent detection and in early development in sport. The fourth presents four observations based on these reviewed studies. The fifth discusses benefits and limitations associated with the use of physical skill tests in early phases of sport development. The sixth offers suggestions for reducing the use of batteries of physical skill tests in early phases of sport development and for improving the tasks and settings of some of these tests.

EARLY INVOLVEMENT IN SPORT: EASTERN AND WESTERN APPROACHES

Traditional sport training theories from the former Soviet bloc countries (Bompa, 1999; Matveyev, 1981; Zatsiorsky, 1995) postulate that talent detection and its associated processes—talent identification, talent selection, and talent development—should primarily be stages of elite sport programs for both individual and team sports. Briefly, as distinguished by Williams and Reilly (2000), talent detection refers to the discovery of potential performers who are currently not involved in any sport program, and talent identification refers to the process of recognizing individuals currently involved in sport with the potential to become elite athletes/players. Talent selection involves the ongoing process of identifying athletes/players at various stages of the training program. For talent selection, the reference to a specific task (i.e., a test) and sport activity is decisive. Talent development implies that the athletes/players are being provided with the appropriate learning/practice conditions to promote and realize their potential in a specific sport.

The main objective of an effective process of talent detection and its related processes in the domain of sport is to search for the gifted child who will eventually achieve a high level of proficiency. Although young prospects can choose for themselves the sporting activities in which they would like to be involved, traditional sport training theories stressed the use of scientific tools in the preliminary stages of talent development. The assumption was that the “professional eye” of the coach, combined with the data that emerged from a controlled testing process, would result in the effective detection of gifted prospects, as well as the appropriate selection of a specific sport for them. In turn, early identification and selection would enable the gifted child to match the natural ability with the specific characteristics and demands of the given selected sporting activity. Focusing from an early stage solely on one sport activity, termed specialization, would ultimately result in the athlete’s reaching the highest stage of the sport program—performing at the international level.

The principles of these traditional sport training theories were enthusiastically adopted by the sport authorities in the former Soviet bloc countries, and they produced world record holders and Olympic champions in a variety of sporting events. These theories perfectly fitted the cultural, educational, and political agendas of the former Soviet bloc countries; their elite athletes were used to maintain their national policy, international affairs, and philosophy of life.

In other regions around the globe, such as North America, models of talent develop-

ment reflecting different approaches of talent detection and early development in sport were proposed (e.g., Bloom, 1985; Côté, 1999). In these Western models, early stages are characterized by free selection of the sport activity/activities and purely having fun with the activity itself. No physical or psychological pressure is made on the child in the early years of involvement in sport. Using a retrospective study—interviewing individuals who have reached a world-class standard so that a picture of the processes of their talent detection and early development could be obtained—Bloom (1985) developed a three-phase learning model: (1) early years—stage of initiation, (2) middle years—stage of development, and (3) late years—stage of perfection. This model emphasizes the contribution of external sources, such as the family and mentors of the young prospects, to the prospects' development and achievement. In addition, the model stresses that without a long-term commitment these prospects will not be able to reach the summit in their domain.

Following Bloom's (1985) view on talent development, Côté and colleagues (Côté, 1999; Côté, Baker, & Abernethy, 2007) proposed a specific developmental model for sport. Côté's model is composed of four developmental stages: (1) sampling years (participating in different sports for fun and enjoyment), (2) specializing years (starting at about age of 13—focusing on one or two sport activities), (3) investment years (starting at about age of 16—achieving proficiency in one or two sport activities), and (4) recreational years (participating in several sport activities, not for achieving proficiency but mainly for fun and good health).

The ideas proposed by Bloom (1985) and Côté and colleagues (Côté, 1999; Côté et al., 2007) have also been supported by Saltin (2007), who argued that two essential factors should be considered by those professionals involved in talent detection and early development in sport. First, sport should be perceived by the young prospect as a fun activity. Second, the biological maturation of the young prospect should be taken into account in early stages of talent development, rather than chronological age. With respect to biological maturation, Saltin stressed that strength training and conditioning have not been found to be effective before puberty. Specific training before puberty should be devoted mainly to the acquisition of motor skills. Enlargement of muscle mass (strength) and of anaerobic and aerobic capacities should be postponed until the young prospect passes the puberty stage. The emphasis of training on various factors related to sport performance in children at different biological stages is presented in Table 1.

A comparison between the Eastern and Western approaches to talent detection and early development in sport indicates that there has been a shift in emphasis from talent detection and talent identification (i.e., the Eastern approach) to talent development (i.e., the Western approach) (Durand-Bush & Salmela, 2001; Martindale, Collins, & Daubney, 2005). Regardless of the approach adopted by policy makers in talent detection and early development in sport, young prospects, their coaches, and quite often their parents request feedback information on the prospects' progress and particularly on their chances to advance to higher stages in the sport model/program. To comply with this request, coaches use a variety of tests to assess the prospects' ability so that relevant information can be obtained to provide to the prospect, the coach, and the prospects' parents.

Table 1. Emphasis of Training on Various Factors Related to Sport Performance in Children at Different Biological Stages

	Pre-puberty	Puberty	Post-puberty
Motor skills	+++	++	+
Muscle mass (strength)	n/a	+	+++
Anaerobic capacity	n/a	+	++
Aerobic capacity	+	+	+++

(Adapted from Saltin, 2007) major emphasis: +++ ; normal emphasis: ++ ; minor emphasis: +

THE PHYSICAL SIDE OF TESTING: PHYSICAL, PHYSIOLOGICAL, MOTOR, AND SKILL COMPONENTS

A variety of tests that assess the physical components of the multi-faceted sporting ability of young prospects involved in early phases of talent development have been described in the literature. Among these are physical tests, physiological tests, motor tests, and skill tests (see Brown, 2001; Gore, 2000). Although there are different names for these testing devices, their main objective is to assess the physical (e.g., endurance, speed, and strength) and motor (e.g., balance, coordination, and kinaesthesia) abilities of young prospects, as well as their skill level in a given sport (e.g., dribbling in soccer and team-handball or serving in tennis and volleyball). The information obtained from these tests can help the coach answer such questions as: How fast can the prospect run? How high can the prospect jump? and How accurate is the prospect in throwing the ball at the target? Some of these tests are performed in the field, and others are administered under controlled laboratory conditions. A number of these tests (e.g., agility, endurance, and speed tests) mainly require the use of the performer's own body with the tester using a small piece of equipment such as a stopwatch, and others (e.g., explosive power, dribbling, and basketball shooting tests) demand performance of the activity/task using specific and task-related piece of equipment such as a medicine ball, a basketball, or a rope. All the tests require a high level of physical ability, as well as a certain degree of motor skill mastery.

For the particular purposes of this paper, we use the term physical skill tests when referring to those tests given to young prospects to assess their motor, physical, and physiological abilities, as well as their skill level. The majority of the physical skill tests administered to young prospects in early phases of talent development are composed of both physical and skill components. In some tests the dichotomy between the physical component and the skill component is clear; however, in others, it can be somewhat indistinct. For example, the standing long jump test, which assesses the explosive power of the legs (Kirby, 1991; Strand & Wilson, 1993), has been a popular item in a battery of tests used by coaches at early stages of sport development (e.g., Lidor, Hershko, Bilkevitz, Arnon, & Falk, 2007; Williams & Reilly, 2000). However, in order to jump as far as possible, individuals sometimes move their hands in a certain way, or bend their trunks to

a certain degree, in order to gain a few more centimeters in a given jumping trial. Thus, it is clear that this test requires a certain level of skill in order to attain a higher achievement. In some physical skill tests used by coaches, such as the standing long jump, the physical aspect is more defined than the skill aspect. However, in other tests, such as in the slalom-dribbling test, which is used quite often in ball-game activities, the opposite is the case (Strand & Wilson, 1993). In order to achieve a high level of proficiency in this test, the performer is required to be familiar with the mechanics and techniques of the act of dribbling, namely how to push the ball down and forward, how much power to release so that the ball will bounce at the appropriate height, and on which environmental cues to focus attention. The performer is not only required to demonstrate a high level of technical skill with the ball but also to run fast while following a specific pathway. In both tests—the standing long jump and the slalom-dribbling—a proficient combination of the physical and skill aspects of the test should help the individual attain a high level of proficiency.

THE USE OF PHYSICAL SKILL TESTS IN TALENT DETECTION AND IN EARLY DEVELOPMENT IN SPORT: EMPIRICAL INQUIRIES

Thirteen studies examining the effectiveness of physical skill tests administered in early years of sport development are reviewed in this part of the paper. In several of the studies (e.g., Falk et al., 2004; Reilly et al., 2000), psychological tests were also given to the young prospects; however, the majority of the tests examined only physical skills. The studies are divided into team (ten studies; five on male athletes, four on female athletes, and one on both female and male athletes) and individual (three studies; two on male athletes and one on both female and male athletes) sports.

In a typical study, the achievements of talented athletes/players were compared to less-talented athletes/players in order to distinguish the physical ability and skill level between the two groups. In addition, the achievements of the talented and less-talented athletes/players were correlated with “real-world performance” variables, such as competition/game performances or rankings made by the coach in order to discover the best predictors of the athletes’/players’ future success. Researchers observed the overt behaviors of the participants (i.e., the prospects) and described the observed events (i.e., the prospects’ achievements in the physical skill tests) in detail (Thomas & Nelson, 2005). No experimental manipulations were undertaken by the researchers.

TEAM SPORTS

Studies on water polo (Falk et al., 2004), team-handball (Lidor, Falk et al., 2005), volleyball (Lidor, Galili, Arnon, & Pilz-Burstein, 2007; Lidor, Hershko et al., 2007; Stamm, 2004; Stamm & Stamm, 2004; Stamm, Stamm, & Thomson, 2005), field hockey (Spamer & Coetzee, 2002), netball and rugby (Pienaar, Spamer, & Steyn, 1998), and soccer (Reilly et al., 2000) are reviewed. Because testing procedures were similar across studies (for the team as well as the individual sports), the testing procedures used in only

one study on team sport (water-polo; Falk et al., 2004) were described in detail. In this study, 24 players aged 14-15 years underwent a battery of tests three times during a two-year period prior to selection to the junior national team. The tests included 50m, 100m, 200m, and 400m freestyle swims, 100m breaststroke, 100m "butterfly" (with breaststroke leg motion), 50m dribbling, throwing at the goal, throwing for distance in the water, vertical "jump" from the water, and evaluation of game intelligence by two coaches. A comparison of those players eventually selected to the team and those not selected demonstrated that the selected players were already superior in most of the swimming tests as well as in dribbling and game intelligence two years before selection. This superiority was maintained throughout the two years. In addition, it was found that, based on the baseline scores, the prediction for 67% of the players was in agreement with the selection to the junior national team.

Other studies on prospects in team sports yielded different prediction rates. One volleyball study on adolescent players (Stamm, 2004) showed that height, weight, and age determined the variability of the other basic measurements in 33% of the players, with the prediction rate of up to 50%, and in 75% of the players the prediction rate reached 50-90%. Another volleyball study (Stamm et al., 2005) on 13-16 players showed that psychophysiological tests such as perception tests, reaction times to visual stimuli, and anticipatory reflection of reality, as well as anthropometric variables such as weight, height, xiphoidal height, and suprasternal height, explained between 38 and 98% of real volleyball performances.

Not only were the prediction rates varied across studies, but different physical skill tests were identified for predicting future success. In a team-handball study (Lidor, Falk et al., 2005), it was found that the only good indicator of future selection of players to the Junior National Team was a skill test: slalom dribbling. In a volleyball study (Lidor, Hershko et al., 2007), comparisons between selected and non-selected 16-year male players revealed that only one physical explosive power test—vertical jump with approach—was found to be a good indicator for distinguishing between the two groups of players. However, when female volleyball players of a similar age underwent a battery of physical skill tests, different results were obtained (Lidor, Galili et al., 2007): the vertical jump with approach, standing long jump, and agility tests were found to be the best predictors for ranking players. In another team activity, soccer, the most discriminating measures between elite and sub-elite 15-16 year-old players were agility, sprint time, and anticipation skill (Reilly et al., 2000). In addition, the elite players were significantly leaner, possessed more aerobic power, were more tolerant of fatigue, and were better in dribbling but not shooting. In rugby, among 14 physical skill tests administered to 10-year-old boys, only eight variables—four motor (e.g., sprint and vertical jump) and four anthropometric (e.g., body mass and femur width)—discriminated maximally between the talented and the other players at this age (Pienaar et al., 1998).

INDIVIDUAL SPORTS

Mixed results were also reported in studies searching for the most effective physical skill tests aimed at predicting future success for judo and tennis. In one judo study, ten judokas (12-15 years of age) underwent assessment of general ability and specific judo ability three times during a training program (Lidor, Melnik, Bilkevitz, Arnon, & Falk, 2005). Following the twelve-month training program the judokas were ranked by the two national judo coaches. Eight years after the beginning of the training program, the judokas were ranked again by the same national coaches. It was found that the specific judo ability test did not correlate with the rankings, and only the general ability test was found to correlate with the rankings made by the coaches. Different findings were reported in two studies on prospects in tennis. In a mixed longitudinal prospective study on 11-15 year-old female and male tennis players, high performance players (i.e., players who regularly attained a semi-final position in tennis tournaments) were compared with competitive players (i.e., players who regularly attained a quarter-final position in the same tennis tournaments) and with a control population (i.e., players who attended no more than one practice per week; non-competitive players) (Elliott, Ackland, Blanksby, & Bloomfield, 1990). It was reported that the agility run test significantly differentiated the male high performance players from the other two male groups, and the grip strength test, speed test, and vertical jump test significantly differentiated the female high performance players from the other two female groups.

In another tennis study, U.S. Tennis Association (USTA) players (mean age = 15.4 yrs), participants in a tennis developmental camp (mean age = 13.6 yrs), and juniors attending a USTA training center underwent the USTA battery of motor and physical tests to determine whether any of the tests' items were related to tennis performance (Roetert, Brown, Piorkowsky, & Woods, 1996). The results yielded an accurate prediction of 95.5% for the USTA National Team, 91.3% for the developmental camp participants, and 87.5%, for juniors attending USTA area training centers. It was found that, without including either gender or age, physical variables such as speed, strength, agility, and flexibility had strong relationships to tennis performance.

WHAT CAN WE LEARN FROM THE DATA ON THE USE OF THE PHYSICAL SKILL TESTS?—FOUR GENERAL OBSERVATIONS

Four main observations can be made based on the data from studies examining the use of physical skill tests in early years of talent development. First, physical skill tests (as well as anthropometric measurements) can be used as tools for assessing athletic ability and predicting future success of athletes in a variety of individual and team sports, such as field hockey (Spamer & Coetzee, 2002), judo (Lidor, Melnik et al., 2005), netball (Spamer & Coetzee, 2002), rugby (Pienaar et al., 1998; Spamer & Coetzee, 2002), soccer (Reilly et al., 2000; Spamer & Coetzee, 2002), team-handball (Lidor, Falk et al., 2005), volleyball (male players – Lidor, Hershko et al., 2007; female players – Lidor, Galili et al., 2007; Stamm, 2004; Stamm et al., 2005), and water-polo (Falk et al., 2004). In

these studies, a variety of motor abilities, such as agility, exclusive power, flexibility, and speed, as well as sport skills, such as dribbling, kicking, and passing, were measured in both field tests and well-controlled laboratory tests.

The second observation is that all the reviewed studies were cross-sectional rather than longitudinal. In a longitudinal study, one group of subjects is observed for a long period of time, and in a cross-sectional study, several groups are observed for relatively short periods of time (Thomas & Nelson, 2005). The classic longitudinal study lacks the comparability effect that can be gained in a cross-sectional study; however, it enables researchers to collect data on a variety of dependent variables and, therefore, study developmental perspectives of the observed group. In several studies on the use of physical skill tests with athletes in early years of sport development, the period of data collection lasted between one and two years (e.g., Falk et al., 2004; Lidor, Hershko et al., 2007). However, in most studies the length of the period in which data collection took place was shorter (e.g., Reilly et al., 2000; Stamm, 2004). If the aim of the study is to examine the contribution of physical skill tests to talent detection, and particularly to talent development, then it would be beneficial to conduct a longitudinal study. From an expert theory perspective, it has already been established (e.g., Ericsson, 2003) that a period of at least ten years is required to achieve expertise in sport, as well as in other domains such as art, music, and science. Therefore, the lack of longitudinal studies is a serious methodological obstacle to achieving full understanding of the contribution of physical skill tests to the prediction of the talented prospects' future success.

The third observation is that physical maturation was not taken into consideration in the different groups of talented and less-talented prospects. Maturation can affect anthropometric measures, as well as body composition (Malina et al., 2004). Achievements in physical skill tests can be substantially influenced by early or late maturation. In the reviewed studies, it is possible that the talented athletes/players were more physically mature during the period of data collection than the less-talented athletes/players. In order to accurately distinguish between talented and less-talented individuals, data on maturation level should be included.

The fourth observation is that no clear-cut evidence has been found to support the predictive value of physical tests in talent detection and early development in sport. There are some data indicating that some physical skill tests given to young prospects for talent detection and in early sport development stages serve as good predictors for performance in actual games or final rankings of athletes/players (see Lidor, Hershko et al., 2007; Pienaar et al., 1998; Stamm et al., 2005). However, data obtained from a variety of additional studies indicated no correlation of physical tests with final selection and ranking of athletes/players (e.g., Lidor, Falk et al., 2005; Lidor, Melnik et al., 2005). In addition, different physical skill predictors for actual performances or final rankings of athletes/players were found for male and female athletes/players, such as the medicine ball throw for female volleyball players (Stamm & Stamm, 2004) and the vertical jump with approach for male volleyball players (Lidor, Hershko et al., 2007).

Although it was observed that physical skill tests have been used frequently in assessing early stages of talent development (Observation 1), Observations 2, 3, and 4

provide us with some “food for thought” on the actual effectiveness of these tests. In this respect, a number of questions can be asked: Are the physical skill tests given to young prospects sensitive enough to distinguish between talented and less-talented prospects? Can these tests predict future achievements/success of young prospects? Finally, can coaches obtain the relevant information that they want by using physical skill tests? A further analysis of (a) the procedures of the physical skill tests administered in the reviewed studies, (b) the tasks performed by the prospects, and (c) the settings in which the tasks were performed did reveal a few benefits of the tests but also a number of limitations, as will be described in the following section.

THE USE OF PHYSICAL SKILL TESTS IN TALENT DETECTION AND EARLY DEVELOPMENT IN SPORT: TESTING-SPECIFIC BENEFITS AND LIMITATIONS

Three benefits and four limitations are outlined, based on the use of batteries of physical skill tests in talent detection and during early development in sport.

WHAT BENEFITS CAN BE OBTAINED BY THE USE OF THE TESTS?

(1) The results obtained from the physical skill tests can provide feedback to the athletes/players so that they can effectively monitor their progress throughout the entire training program. Appropriate use of this feedback can also motivate the prospect to attain greater achievements.

(2) The results obtained from the tests can help coaches effectively plan the training program, which in turn will better reflect the current physical needs of the prospects.

(3) Norms and criteria for young elite athletes/players can be developed based on the data obtained from the physical skill tests. Coaches will be able to compare the achievements of their athletes/players with other national or international athletes/players.

WHAT LIMITATIONS CAN BE OBSERVED FROM THE USE OF THE TESTS?

(1) Physical skill is only one aspect of testing in the process of talent detection during early development in sport. Psychological and sociological tests that can be used effectively by coaches should also be made available (see Abbott & Collins, 2004; Durand-Bush & Salmela, 2001; Williams & Reilly, 2000). For example, coaches could use these tests if they have difficulty in predicting the willpower of the prospect or in determining what will motivate the prospect during the entire training course, how he or she will be able to cope with stress and competitive situations, or how he or she will overcome injuries. The information obtained from the use of physical skill tests is not useful in assessing the social or psychological abilities of the young prospects.

(2) There is a lack of tests assessing cognitive skills such as game understanding, anticipation, decision making, and problem solving (Williams, 2000). Information on the ability of the prospect to perceive the environment, to anticipate the ongoing activity, to plan responses in advance, or to make a decision as fast and as accurately as possible

would be extremely valuable to coaches, particularly in ball game activities (e.g., soccer and volleyball), combat sports (e.g., judo), and racquet activities (e.g., tennis). Once again, the information obtained from the physical skill tests cannot be used in assessing the cognitive ability of the young prospects.

(3) A majority of the physical skill tests are performed individually and in stationary settings. Therefore, the tasks are performed as closed skills, which may match the requirements of individual sport activities such as gymnastics and track and field but not activities such as ball games, combat sports, and racquet games. In ball games, combat sports, and racquet games, the players are usually asked to perform open skills, which require players to anticipate, make decisions, solve problems, and evaluate (Schmidt & Wrisberg, 2004). The players have to apply thought processes in a constantly changing environment. Therefore, the assessment of the physical ability of the prospects and their skill level, when taking place in a closed setting, is somewhat limited in terms of the predictability effect of the ability of the prospect to perform in a real-world sporting event.

(4) Physical skill tests are performed in a rested state; the athletes/players perform when they feel ready, according to the protocols of the tests. In this respect, it has been shown that fatigue can influence certain mechanisms operating from the input of information to the output. Fatigue primarily affects the central processes involved between information receipt and the initiation of a movement (Pack, 1974). General body activity and moderately high fatigue will impair performances requiring strength, endurance, and rapid movements. Therefore, it is of particular interest to the coach to assess prospects' ability not only under rested conditions but also under physical exertion conditions that reflect what is required of them in real-world sporting situations.

TO TEST OR NOT TO TEST?

Based on the assessments made of the studies reviewed in this paper and on the benefits and limitations associated with the physical skill tests administered in these studies, we would like to make two recommendations for coaches and others involved in early stages of talent development in sport, such as sport consultants, policy makers, physical educators, and family members of the young prospects. First, coaches should limit the use of physical skill tests for the objective of talent detection during early phases of sport development, particularly among pre-pubescent prospects. Second, coaches and researchers specializing in measurement and evaluation in physical education and sport should exhibit mutual cooperation in order to improve the use of various items included in the batteries of the physical skill tests.

It is true that physical skill tests can help the coach in assessing physical abilities and the skill level of young prospects, both in individual and team sports. Information obtained from these tests can be used effectively to assess the current physical state of the talented prospects, as well as in developing appropriate training programs that will enable the prospects to realize their potential or overcome deficiencies. Physical skill tests should be administered in order to obtain information that can be used to augment feedback provided to the prospects and their coaches. This feedback can focus on a variety of instructional aspects, such as the individual achievements of the prospects and

the sensitivity of the training program to the prospects' current physical needs, as well as on the realization of the short- and long-term goals set by the prospects and their coaches. Appropriate use of physical skill tests can assist the coach in strengthening the physical and technical fundamentals of the training program and in making an accurate evaluation of the contribution of the program to the progress of the prospect.

However, no clear-cut evidence has been found to support the predictive value of physical skill tests in talent detection during development in sport. The limitations associated with the use of these tests, as outlined earlier, may decrease their probability of accurately predicting the prospects' future ability success. In addition, achievement and success in sport are multi-determined and are influenced by a complex interaction of various components related to the action situation, such as the individual's skill or the environment. Administering physical skill tests is a time-consuming process; it requires skilled individuals who are familiar with measurement procedures, specific measurement equipment, safe settings, and the cooperation of all those involved in the testing process, particularly the prospects and their coaches. Therefore, we propose that the physical skill tests be administered only a few times throughout the training program, when there is a crucial need for feedback on the prospects' progress.

Reducing the use of the tests is one proposal. The second proposal deals with improving the current physical skill tests, mainly from two perspectives—tasks and settings. The tasks performed in the tests should reflect actual actions, similar to the ones the prospects are required to perform in actual competitions or games. It was pointed out earlier that, in sport activities such as ball games, combat sports, and racquet activities, open motor skills are performed that require the individual to activate thought processes in order to perceive the on-going information and make appropriate decisions. The majority of the physical skill tests administered in the studies reviewed were not sensitive enough to the need of the prospect to perform and to be assessed in an open environment. Therefore, coaches should change the closed-skill tests included in the present batteries to more open-skill tests. For example, the vertical jump with approach test, which was used in a few studies (e.g., Lidor, Hershko et al., 2007; Stamm & Stamm, 2004), could be substituted by another volleyball action, namely an attack, with another player setting up the attack. In this case, not only will the vertical jump reflect a more vivid game situation, but cooperation between individuals, which is required in game situations, will be achieved as well. In a more complex situation, the player can perform the attack against a defender. Adding another stimulus, such as a defender, to the test would demand that the player anticipate, make a decision, and respond as fast and as accurately as possible. This testing situation, although more difficult to evaluate, would probably reflect activities that occur in actual volleyball games more accurately.

Improvement should also result from changing the settings in which the physical skill tests are administered. For example, the physical skill tests administered in the reviewed studies were performed in rested conditions. One of the goals of the coach should be to match the conditions in practice with those expected during an actual performance, such as in competitive situations. Therefore, it would be of particular benefit to the coach to assess the prospects' physical ability and skill level not only under rested conditions

but also under physical exertion conditions that reflect real-world situations. Practically speaking, the rested/physical exertion conditions in the tests should be manipulated (e.g., high vs. low levels of physical exertion) to be more sensitive to the actual requirements of the sporting event.

We contend that coaches should be aware of the drawbacks and limitations of the use of physical skill tests in early stages of talent development and its associated processes—detection, identification, and selection. The interrelationships of the prospects, the tasks they have to perform, and the settings in which these tasks are performed should be carefully examined by coaches when selecting tests to assess the physical abilities and skill levels of prospects. These interrelationships may be altered during the different processes of talent development. For example, in the detection process, the coach should collect information in order to answer the basic question—does the youth prospect want to be an athlete? In another process, the selection process, the coach faces a different question—what specific task within the given sport can be best performed by the prospect? In the first case, the detection process, the prospect is the major factor to be considered by the coach, and in the second, the selection process, the task is the major factor.

Sensitive physical skill tests for the use of coaches in early phases of talent detection and development should be developed through a combined effort of coaches and researchers specializing in measurement and evaluation in sport. This effort will aid in increasing the ecological validity of the physical skill tests and, therefore, elevate their contribution during early stages of sport development. Finally, it is our understanding that physical skill tests can contribute only to the physical component of developing talent in the domain of sport. Additional factors such as psychological preparation and social support should also be included in order to obtain the most comprehensive picture of the ability of the prospect to attain a high level of proficiency.

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