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The Impact of a Proposed Educational-Sports Program of Developing Basic Speed Components (Sprint, Reaction, And Movement Frequency Speed) On Third-Year Students of Physical Education and Sports

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Abstract:
This study aims to evaluate the impact of a proposed educational sports program based on Speed-Agility-Quickness (SAQ) training and small-sided games on developing basic speed components (sprint, reaction, and movement frequency speed) on third-year middle school students (aged between 14-15 years old). The study is experimental in design, it was conducted on a population of third year students at "Zighoud Youcef" Middle School in "Setif" Province, Algeria. A 40-student sample was purposively chosen and divided into two equivalent groups (experimental and control). Pre- and post- tests measurements were used to assess and measure the impact of the treatment. The proposed program was applied on the experimental group for eight weeks, at the rate of three sessions per week, while the control group followed the regular curriculum. The results showed statistically significant differences ($p < 0.05$ p<0.05) in favor of the experimental group across all speed components, with medium to large effect sizes ($d > 0.6$ d>0.6), confirming the effectiveness of the proposed program. The study recommends integrating of specific speed training and small-sided games within physical education classes to enhance motor skills in adolescents.

Keywords: Sports educational program, Sprint speed, Reaction speed, Movement frequency speed, Middle school students, SAQ.

1. Introduction and Problematic:

The field of physical education and sports is undergoing a significant shift in its knowledge structure; it is no longer seen as a transient movement activity but as a scientifically planned educational process aimed at directing the learner's biological potential towards the highest levels of development (Haff & Triplett, 2016, p. 382). The middle school stage (12-15 years) represents a critical developmental fulcrum, characterized by high neural and physiological adaptability, which Lloyd and Oliver (2012, pp. 61-72) describe as the "Golden Windows of Opportunity", where the response to training stimuli is at its peak, speed; with its three components (sprint speed, movement frequency speed, and reaction

speed), is particularly prioritized during this phase, as it is directly related to the maturation of the neuromuscular system and is crucial for overall motor performance (Lloyd et al., 2016, p. 1492).

However, the use of this 'golden window' for speed development remains controversial. The traditional reductionist approach, which has been predominant in the field, relies primarily on linear repetitive running, which has been shown to be limited in inducing deep and sustainable neural adaptations (Ramirez-Campillo et al., 2020, pp. 2125-2143). In contrast, the modern integrative approach is based on the principle of multidimensional neuromuscular stimulation, and its effectiveness has been supported by empirical studies and systematic reviews through approaches such as the Integrated Neuromuscular Training (INT), Speed-Agility-Response Training (SAQ), and Small-Games (SSGs), which improve speed and explosive power indices, enhance motor coordination, and contribute to injury prevention among young athletes (Faigenbaum et al., 2016, pp. 160-165; Chaabene et al., 2020, pp. 1-13). Despite this theoretical development, its projection onto the reality of practice in the Algerian educational system reveals a notable gap in implementation. Field observations and results of some local research indicate that, in many cases, pedagogical practices in physical education are still far from systematically employing modern approaches to teaching. Moussaoui et al. (2023, pp. 1304-1321) suggests that in the context of evaluating the activities' content of the second-generation curriculum and showed the existence of deficiencies in keeping pace with the requirements of modern sports practice, which negatively reflects on the quality of the physical training of the student. Zeitouni (2019, p. 25), in evaluating the curriculum according to the competencies approach, concluded that the focus may often overlook the practical details necessary to develop physical abilities in a codified manner, making the "golden windows" unrealised developmental opportunities. This failure to build structured sports education programs is reflected in the speed level of students, which appears in their limited motor performance compared to the reference levels for their age group.

Based on the discrepancy between the developmental potential of scientific knowledge and what is actually applied on field, there is a need for a structured intervention that seeks to reduce this gap by designing an educational sports program geared towards the development of speed. Therefore, this research is based on addressing this research gap by proposing a program based on modern physiological and training principles and adapted to the characteristics of third-year middle school students (14-15 years old).

This study aims to:

- Propose an educational sports program to develop the three components of speed (sprint, reaction, and movement frequency speed) in accordance with the developmental characteristics of this age group.
- To investigate the impact of the proposed program on improving the sprint speed of the experimental group compared to the control group.

- Test the effectiveness of the program in developing the reaction and movement frequency speed and verify it by examining the statistically significant differences between the pre- and post-measurements and between the experimental and control groups.
- Formulate procedural recommendations for physical education and sports teachers and curriculum designers, including practical mechanisms for integrating specific speed training and guided games into regular classes.

The importance of this study stems from its contribution to addressing a research and practice gap related to the development of speed components in the school environment and providing a simple and applicable scientific model that supports improving field practices of physical education teachers. Its importance is also evident in its endeavor to raise the level of speed and its basic components among middle school students, reflecting on motor performance and enhancing perceived motor efficiency. Accordingly, the central question of this study is as follows:

Does the proposed educational sports program, based on the principles of neuromuscular training, have a statistically significant effect on the development of the basic speed components (sprint, reaction, and movement frequency speed) in third-year middle school students?

From this main question, the following sub-questions emerge.

Are there statistically significant differences in the level of sprint speed between the pre- and post-measurements among third-year middle school participants of the control and experimental groups?

Are there statistically significant differences in the speed of reaction between the pre- and post-measurement among third-year middle school participants of the control and experimental groups?

Are there statistically significant differences in movement frequency speed between the pre- and post-measurement among third-year middle school participants of the control and experimental groups?

Research hypotheses:

Based on the theoretical framework and previous studies, and in the light of the study objectives, the following hypotheses were formulated:

General Hypothesis:

The proposed educational sports program has a positive impact on developing t some basic speed components (sprint speed, reaction speed, and movement frequency speed) among third-year middle school students.

Partial Hypotheses:

There are statistically significant differences in the level of sprint speed between the pre- and post-measurements among third-year middle school participants of the control and experimental groups, in favor of the post-measurements of the experimental group.

There are statistically significant differences in the level of reaction speed between the pre- and post-measurement among third-year middle school participants of the control and experimental groups in favor of the experimental group
There are statistically significant differences in the level of movement frequency speed between the pre- and post-measurement among third-year middle school participants of the control and experimental groups in favor of the post-measurements of the experimental group

2. Theoretical Framework and Previous Studies

The theoretical framework and previous studies serve as the cornerstone on which the current study is built upon, as it introduces concepts of speed, characteristics of its development in the specific targeted age group, the physiological and training bases for its development, and a review of previous related research which identifies the research gap.

2.1 The Concept of Speed and its Components in Physical Education

Speed in physical education is defined as the ability to perform one movement or a series of similar movements in the shortest possible time (Hassanen 2004, p. 125). It is a compound physical ability rather than a single trait, and it appears in different forms and shapes. Speed is usually categorized into several basic components that contribute to overall motor performance:

Sprint Speed: is the ability to cover a certain distance in the shortest time possible and requires a complex interaction between strength, coordination, and speed-specific endurance (p. 383 (Haff & Triplett, 2016, p. 383).

Reaction Speed: The ability to perform a movement in response to a specific stimulus (visual, auditory, or tactile) in the shortest time possible. Responsive speed is a critical factor in many sporting situations that require quick decision-making (Johnson & Nelson, 1979). 106).

Movement Speed/ frequency: It is defined as the ability to execute successive repetitive movements as quickly as possible within a specified period of time. This speed is related to the efficiency of the neuromuscular system in sending and receiving nerve signals to activate the muscles in a coordinated and rapid manner (Council of Europe 1988).

2.1 Operational Definitions of the Study Variables:

The proposed sports-education program: It is a package of educational-training units based on speed-agility-quickness (SAQ) training and small-sided games, prepared by the researcher and applied on members of the experimental group durig eight (8) weeks, in the rate of three (3) sessions per week, each session lasting 45 minutes, where each session includes a warm-up phase, a main phase focusing on speed development, then a cool-down phase, which is considered the main independent variable of the study.

Sprint Speed: This is the amount of time it takes for a student to cover a distance of 30 meters as fast as possible from the flying start position, as recorded in seconds (s) using

the 30 m flying sprint test, where the value of the recorded time in this test represents the procedural score for the level of sprint speed (the shorter the time, the better the level).
Reaction Speed: The distance measured in centimetres (cm) that the ruler crosses in the Nelson Reaction Timer test before the student succeeds in catching it after letting it fall freely from the examiner's hand; this distance represents the procedural degree of Reaction Speed (the lower the distance value, the better the reaction speed).
Movement frequency speed: This is the number of correct repetitions a participants performs in a 10-seconds period in a test designed to measure movement frequency (for example Plate Tapping test), and the final value is representing the procedural score for movement speed in units of "number of repetitions in 10 seconds." The final value represented the procedural score for the movement speed.
Pupils in the third-year of Middle School: Male students between the ages of 14 and 15 years, enrolled in the third-year of Middle School in the state of Setif during the academic year 2025/2026, who were used subjects of the study sample according to the specified selection criteria (regularity in school, health safety, and attendance in physical education classes).

2.2 Characteristics of the Development of Speed Components at the Age of 14-15 years:

The 14-15 age group is considered to be a crucial stage in the physical and physiological development of adolescents, with accelerated neuromuscular development. Lloyd and Oliver (2012, pp. 61-72) refer to this stage as the "Golden Windows of Opportunity", where the body is more responsive to training stimuli. During this period, hormonal and developmental changes occur which affects positively speed-related abilities, such as increased muscle strength, improved neuromuscular coordination, and the development of fast-twitch muscle fibers. Optimizing this phase through targeted training programs can lead to significant and sustainable gains in motor performance (Lloyd et al., 2016, p. 1493). Furthermore, it is the peak of the central nervous system’s development, enhancing the ability to learn complex motor skills and quick responses (Bompa & Buzzichelli, 2015, p. 21).

2.3 Physiological and Neuromuscular Basis of Speed Development:

Speed development is mainly based on physiological and neuromuscular adaptations. Physiologically, speed is related to the efficiency of anaerobic energy production via the phosphagen system (ATP-PCr) and the percentage of fast-twitch muscle fibers in working muscles (Bompa & Haff, 2009). 115). Neurologically, the speed of neurotransmission, the efficiency of muscle neural drive, and motor unit synchronization play a pivotal role in achieving maximum speed (Myer et al., 2015, p. 5). Training that intensively and directionally stimulates the neuromuscular system, such as plyometric training and speed training, leads to neural adaptations that increase encoding rate of motor units’ frequency, improving force and speed (Lorenz, 2016, p. 48). Sale (1988, pp. S135-S145) suggests that

neural adaptations is the most important factor in the early stages of strength and speed training among young people.

2.4 The Theoretical Basis of the Proposed Sports-Education Program:

The proposed program is based on several modern training principles that have proven effective in developing the physical abilities of young people.

Speed-Agility-Agility-Quickness (SAQ) drills: SAQ is defined as a set of exercises designed to improve the ability to perform fast and explosive movements while efficiently changing direction. SAQ drills include the development of sprinting speed, agility which is the ability to rapidly change direction while maintaining balance, and quickness which is the ability to respond to stimuli with a quick movement. Recent studies, such as Sun et al. (2025, pp. 1-10) have shown that SAQ training effectively reduces reaction time and improves overall athletic performance. Chaabene et al (2020, p. 1-13) also noted that curated design of SAQ program can significantly improve motor abilities in young athletes.

Integrative Neuromuscular Training (INT): This concept focuses on improving the efficiency of communication between the nervous system and muscles, leading to improved balance, strength, power, ability, and agility (Faigenbaum et al., 2016, pp. 160-165). INT involves exercises that enhance the coordination between muscles and joints and improve the body's ability to respond quickly to changing situations. These interventions are essential for minimizing injuries and improving overall motor performance (Myer et al., 2011).

Small-Sided Games (SSGs): Small-sided games are considered to be an effective and enjoyable training method that allows players to develop their physical and technical skills within a realistic game context. These games contribute to improving reaction speed, sprint speed, and movement speed, in addition to boosting cognitive aspects and motivation (Wang, 2024, pp. 1-12). They also contribute to breaking routines and developing tactical creativity, as they provide intrinsic motivation to participants (Davids et al., 2013, p. 167).

Training Principles: The design of the program is based on basic training principles such as specificity (directing training towards targeted components), progressive load (gradually increasing volume and intensity), variety and excitement (using different training methods to maintain motivation), and the relationship between work and rest to ensure optimal recovery and adaptations (Lloyd et al., 2016, p. 1494).

2.5 Previous Studies:

Numerous studies indicate the high effectiveness of targeted training programs in developing speed and its components in youthful groups. The most prominent of these studies can be reviewed under two main categories.

Firstly, Relevant International Studies such as Ramirez-Campillo et al. (2020, pp. 2125-2143) which conducted a systematic review and meta-analysis, this study confirmed the positive impact of plyometric training on improving jump performance and sprinting speed in youth soccer players. This strongly supports the integration of simplified and structured forms of these exercises into the current proposed program. Luo et al.'s study (2025, pp.

406-452) demonstrated the superiority of structured training programs, which combine strength and plyometric training over traditional programs in developing physical capabilities (such as jumping and sprinting speed) among young athletes.

Secondly, on the Arab and local regions, various studies in school and sports settings investigated the efficiency of educational-sports programs. Ben Dahina (2019, pp. 45-62) highlighted the traditional physical education classes' deficiency in providing targeted training situations to develop students' physical abilities, confirming the urgent need to design more specialized training programs to bridge this gap. While Younes and Bodaoud (2024, pp. 275-288) confirmed that the implementation of small-sided games effectively contributes to improving agility, change-of-direction speed, and acceleration among school students.

Bouhafs (2018, pp. 16-29) also investigated the impact of speed, agility, and coordination exercises on developing specific physical abilities in under-17 soccer players, concluding with results strongly advocating for early training interventions. Meanwhile, Ferhati and Kattaf (2020, pp. 85-98) presented a training program using small-sided games to develop specific speed-related physical traits in primary school students, thereby this reinforces the methodology of using small-sided games, even in younger age groups.

Other studies such as Bouhafs and Nouri (2022, pp. 45-60) demonstrated the significant effectiveness of a training program based on SAQ drills in developing sprinting speed and agility among under-15 soccer players. This clearly indicates that SAQ training is highly suitable and ideal for the target age group of the current study. Whereas Ben Said and Kadri (2023, pp. 112-125) emphasized the impact of a proposed training program on developing reaction time and response speed among youth handball players, underscoring the importance of dedicating specific training specifically aimed at enhancing reaction speed.

3. Research Methodology and Field Procedures:

Methodology is the fundamental pillar that ensures the accuracy and credibility of research findings. The following section is a detailed description of the adopted methodology and the field procedures underlying this study.

3.1 Research Design and Methodology:

In alignment with the nature of the study, which aims to test the impact of a proposed program, the researcher adopted the experimental research design with an experimental and focus groups using a pre and post-tests as an assessment instrument. This design is considered optimal for controlling extraneous variables and isolating the effect of the independent variable (the proposed educational-sports program) on the dependent variables (the fundamental components of speed), thereby allowing for the extraction of accurate and reliable cause and effect relationships (Gall, Gall, & Borg, 2007, p. 463-465).

3.2 Study Population and Sample:

Study Population: The population of the study encompassed all third-year middle school students enrolled at "Zighoud Youssef" Middle School in Setif province for the academic year 2025/2026, totaling (N=120) students distributed across four pedagogical groups.

Study Sample: The study sample was selected using Purposive Sampling from the original population, consisting of (40) participants, thus representing (33.33%) of the overall study population. The sample members were randomly assigned into two equal groups.

- Experimental Group (n=20): Subjected to the proposed educational-sports program (three sessions per week).
- Control Group (n=20): Followed the standard physical education curriculum mandated by the Ministry.

Sample Inclusion Criteria: The researcher meticulously controlled the sample based on The following strict conditions were used to ensure the integrity and objectivity of the results:

- Complete absence of diseases or physical injuries that hinder motor performance (verified via school's medical records).
- Non-participation in any organized, competitive sports activities outside the school setting (to neutralise the effects of external training as an extraneous variables).
- Regular attendance, with no absences exceeding three consecutive sessions.
- Obtaining written consent from parents, ensuring the voluntary participation of the students.

3.3 Homogeneity and Equivalence of the Two Groups:

Prior to initiating the main experiment, the homogeneity and equivalence of the two groups (experimental and control) in the pre-test regarding the controlled variables (age, height, and weight) and dependent variables (speed components) were verified. To achieve this, T-test was utilized to compare the means of both groups. The results indicated that the calculated T-values were not statistically significant at the (p >0.05) across all studied variables. This confirms that both groups fall within the same statistical distribution and start from a comparable baseline, thereby fulfilling the prerequisite condition of pre-test homogeneity and equivalence required for the validity of the experimental design (Tabachnick and Fidell, 2013, p. 125), as illustrated in Table (1):

Table (1): Significance of differences between the means of the experimental and control groups in the pre-test for controlled variables and speed components**.**

Variable	Unit	Experimental (Mean)	Experimental (SD)	Control (Mean)	Control (SD)	T-value	Sig (p)	Significance
Age	Years	14.5	0.4	14.6	0.5	-0.65	0.519	Non-significant

Height	cm	162.3	4.8	161.9	5.1	0.28	0.778	Non-significant
Weight	kg	55.7	3.2	56.1	3.5	-0.41	0.685	Non-significant
Sprint Speed	seconds	5.31	0.25	5.28	0.27	0.38	0.707	Non-significant
Reaction Speed	cm	19.8	1.5	20.1	1.7	-0.62	0.539	Non-significant
Movement Frequency Speed	Count	38.2	2.1	37.9	2.3	0.41	0.684	Non-significant

(**Source:** Prepared by researchers, 2026)

Commentary on the table: Table (1) shows all significance levels (Sig.). are greater than the adopted alpha level ($p>0.05$), indicating no statistically significant differences between the experimental and control groups in the pre-test for all studied variables. This confirmed the equivalence and homogeneity of the sample members prior to the implementation of the proposed program.

3.3 Data Collection Tools

The data collection tools consisted of a set of standardised physical tests and anthropometric measurements appropriate for the target age group (14-15 years). These tools possess acceptable psychometric properties of validity and reliability, as documented in the scientific literature (Baumgartner et al., 2007, p. 112).

Physical Tests:

- **Flying 30m Sprint Test (Sprinting Speed):**
- **Objective:** To measure the maximum sprinting speed after eliminating the acceleration phase.
- **Equipment:** Electronic stopwatch with 0.01 seconds accuracy, a metric measuring tape, cones to mark the acceleration zone and finish line, and a whistle.
- **Procedure:** A 10-meter acceleration zone was marked before the actual starting line. The participant initiates a sprinting run starting from the acceleration zone. The stopwatch was triggered when the participant crosses the starting line and stopped when they cross the finish line at the 30-meter mark. The participant is given three attempts, and the best result (lowest time) in seconds and split seconds is recorded as the operational score for sprinting speed (Haff and Triplett, 2016, p. 409).
- **Nelson Ruler Drop Test (Reaction Speed):**
- **Objective:** To measure the visual-motor reaction speed of the dominant hand.
- **Equipment:** A graduated ruler (30–50 cm in length), a chair, and a table of a suitable height.

- **Procedure:** The participant sits with their forearm and extended hand resting on the edge of the table, keeping the thumb and index finger approximately 2.5 cm apart, ready to catch. The examiner holds the ruler vertically emphasizing that the zero mark aligns perfectly with the upper edge of the participant's thumb. The examiner releases the ruler suddenly and without prior warning, and the participant must catch it as quickly as possible. The distance at the catch point is measured in centimeters. The attempt was repeated three times, and the average distance was calculated; a shorter distance indicated a better reaction speed (Johnson & Nelson, 1979, p. 106).

- **Plate Tapping Test (movement frequency speed):**

- **Objective:** To measure the movement frequency (repetitive speed) of the upper limb.

- **Equipment:** An adjustable flat table, two circular discs (20 cm in diameter each) positioned with their centers by 60 cm apart, a rectangular plate in the middle (30×20 cm), and a stopwatch.

- **Procedure:** The participant stands in front of the table and places their non-dominant hand on the central rectangular plate. Upon the start signal, they alternately tap on the two discs with their dominant hand as fast as possible for 10 seconds. The number of correct taps completed within the time limit is counted. The best result from the two attempts is recorded as the operational score for movement speed (Council of Europe, 1988, p. 45).

Second: Anthropometric Measurements

Total Height: Measured using a stadiometer graduated to the nearest 0.1 cm, with the participant in an upright standing position without shoes (Norton & Olds, 1996, p. 35).

Weight: Measured using a calibrated electronic medical scale, while the participant is wearing a light sports clothing and no shoes; the value was recorded to the nearest 0.1 kg (Norton & Olds, 1996). 40).

Chronological Age: Calculated in years and months based the date of the pre-tests, depending on the documented birth dates in the educational institution's official records (Morrow et al., 2015, p. 108).

3.4 Validity and Reliability of the Study Tools

This study relied on a collection of standardised physical tests and anthropometric measurements that are widely used in physical education and kinesiology research. These tools possess robust scientific documentation confirming their high psychometric properties (validity and reliability) in the specialised literature, as follows:

Sprinting Speed: The used flying 30m sprint test is endorsed by the National Strength and Conditioning Association (NSCA) in its reference manual as a highly reliable, standardised test for estimating maximum speed in youth populations (Haff & Triplett, 2016). 409).

Reaction Speed: The visual-motor reaction speed was measured using the Ruler Drop Test, which is considered a reliable classical tool for motor measurement. It is documented in measurement and evaluation references as one of the highly valid and credible test along its appropriateness for school demographics within the target age group (Johnson & Nelson, 1979). 106).

Movement Speed: The Plate Tapping Test was used by the European Physical Fitness Battery (Eurofit). This standardised battery was developed based on extensive field studies, and official reports confirm its high and acceptable reliability in measuring motor frequency for the 12–16 age group (Council of Europe, 1988). 45).

Anthropometric Measurements (Height, Weight, Age): Internationally recognized standard procedures were used to standardise measurement conditions (clothing, body posture, and equipment calibration) to ensure measurement validity and objectivity within the study environment (Morrow et al., 2015, pp. 107-110).

Based on the aforementioned points, the researcher relied on the validity and reliability coefficients documented in the scientific literature for these tests. Given that they are standardised global measurement tools, the need to conduct a separate local pilot study to calculate these properties was obviated.

3.5 Organizational Description of the Proposed Educational Sports Program:

The proposed educational-sports program was constructed based on the physiological and pedagogical foundations of youth training, with strict consideration of the developmental characteristics of middle school students (14–15 years old). The organizational and scientific framework of the program is defined by the following dimensions:

A. Scientific Foundations of the Program:

Principle of Specificity: Session's content was directly oriented towards developing the targeted speed components. This was achieved by incorporating exercises that mimic sprinting speed (bursts and short sprints), reaction speed (situations demanding rapid responses to visual and auditory stimuli), and movement speed (high-frequency motor exercises).

Principle of Progression: Training load was organized according to a scientifically calculated the progression in volume and intensity. It transitioned from simple to complex movements, from shorter to relatively longer distances, and from shorter to longer work intervals with precise control of rest periods, aligning with the physiological capacities of the target group (Bompa and Haff 2009, p. 225).

Principle of Variation: The program integrated small-sided games and brief competitive drills within sessions to break the routine and motivate students. These leverages adolescents' natural inclination towards gamification and challenge to serve the goals of speed development. (Davids et al., 2013). 167).

Scientific Reference: The program's design was guided by the recommendations of the Long-Term Athletic Development (LTAD) models, which emphasize the high efficacy of short to medium-term training interventions (8–12 weeks) in improving the physical capabilities of youth (Lloyd et al., 2016, p. 1494).

B. Organizational Parameters of the Program:

Total Duration: Eight (8) consecutive weeks.

Training Volume: Twenty-four (24) training units, at the rate of three (3) sessions per week (e.g. Sunday, Tuesday, and Thursday).

Session Duration: Forty-five (45) minutes, which corresponds exactly to the official time allocated to physical education classes in the school system.

• Implementation Location: The educational institution's sports facilities (outdoor court or multi-sports hall, depending on the available resources).

3.6 Structural Framework of the Training Unit

To ensure physiological effectiveness and achieve the highest quality of motor performance, the total duration of the training session (45 minutes) was divided into three main parts:

1. Preparatory Part (Warm-up) – 10 min

- Light, multi-directional jogging to raise core body temperature.
- Dynamic stretching targeting the working muscles (quadriceps, hamstrings, calves, and hip joint musculature).
- Coordination exercises and Neural Activation drills to prepare the central and peripheral nervous system to meet the demands of fast, explosive performance.

2. Main Part – 30 min:

- This segment is dedicated to implementing the core content of the proposed program, including sprinting, reaction, and movement speed exercises.
- Inter-repetition and inter-set rest periods are strictly observed to ensure the replenishment energy substrates (adenosine triphosphate-phosphocreatine). A work-to-rest ratio ranging from (1:3) to (1:5) is maintained to preserve the quality of high-speed execution and avoid excessive neural andmuscular fatigue, adhering to the principle of Quality over Quantity (Bompa & Buzzichelli, 2015, p. 305).

3. Concluding Part (cool-down) – 5 minutes:

- Muscle relaxation and deep breathing exercises to gradually reduce physiological alert and to return the body to its resting state.
- Static stretching for the major muscle groups to accelerate the muscle recovery process and reduced stiffness (Weineck 2011).

3.7 Phased Planning and Load Distribution:

The 8-week training program was organized according to a periodization plan consisting of Three progressive phases to ensure optimal adaptation:

Phase One: Foundation and General Preparation (Weeks 1–2)

- Load Distribution: A relative focus of 60% on sprinting speed (teaching and improving running mechanics and techniques), 25% on reaction speed, and 15% on movement speed.
- Objective: To improve neuromuscular coordination and establish the correct mechanics of movement, as a solid foundation for subsequent phases.

Phase Two: Specific Development (Weeks 3–5):

- Load Distribution: A relatively balanced distribution of 40% sprinting speed, 30% reaction speed, and 30% movement speed.

- Objective: To increase the intensity of the training stimuli and reduce reaction time by incorporating complex drills and more demanding motor situations from a neurological perspective.

Phase Three: Integration and Functional Application (Weeks 6–8):

- Load Distribution: Focusing on integrating all three speed components within a single motor context (Integrated Training).
- Objective: To train participants in dynamic environmental conditions that closely mimic realgame situations (via small-sided games and directed-play scenarios). This requires the precise synchronization of acceleration speed, reaction speed, and movement speed simultaneously (Faigenbaum et al., 2016, pp. 160-165).

3.8 Models of the Proposed Program Content:

To achieve the program's objectives, training units were designed incorporating various applied models, notably:

Sprint Starts: Includes short sprints of distances ranging between 10 and 30 meters from various starting positions (standing, sitting, lying) aiming to develop acceleration and maximum sprinting speed (Bompa 1999, p. 307).

Basic Plyometrics: Incorporates jumping inside hoops, bounding over low hurdles, and progressive hopping. These drills are precisely tailored to the developmental characteristics of the target age group and contribute effectively in improving speed-strength (power) (Carlos-Vivas et al., 2019, pp. 3030-3038).

Tag and Pursuit Games: (e.g., tail tag, hunter games) These are utilized to develop agility and movement speed in dynamic, ever-changing situations while maintaining high levels of excitement and intrinsic motivation among participants (Wang, 2024, pp. 1-12).

Stimulus Response Drills: Activities requiring instantaneous reactions to visual cues (colors, directions) or auditory cues (whistle, clapping), with immediate changes in direction or movement type upon the stimulus' appearance. These models aim to develop reaction speed and the capacity for rapid motor decision-making (Bompa & Buzzichelli, 2015, p. 197).

3.9 Field Application Procedures:

To ensure the integrity of the experimental design and the reliability of the results, the field application of the research went through the following executive phases:

A. Pre-tests: Pre-tests for both groups (experimental and control) were conducted on Saturday and Sunday (October 22 and 23, 2025), in the middle school's courtyard and sports hall. To ensure objectivity, measurement conditions were standardized by:

- Fixing the testing time to the morning session to avoid the effects of daily fatigue.
- Standardizing performance instructions and recording methods for all subjects.
- Enlisting an assistant team of three (3) qualified physical education teachers, after providing them with prior training on the test protocols (Thomas, Nelson, & Silverman, 2011, p. 120).

B. Intervention:
- Experimental Group: Underwent the proposed educational-sports program for eight (8) consecutive weeks (from October 24 to December 18, 2025), with three (3) sessions per week. The program was executed under the direct supervision of the researcher to ensure strict adherence to the planned training load variables.
- Control Group: Continued receiving lessons according to the standard ministerial physical education curriculum, under the supervision of the school's subject teacher, within the official time allocation period.
C. Post-tests:
Immediately following the intervention period, post-tests were conducted for both groups on Saturdays and Sundays (20 December and 21, 2025). The researcher strictly ensured the replication of the exact spatial, temporal, and procedural conditions that prevailed during the pre-tests (same equipment, same examiners, and the same sequence of tests) to control any possible extraneous variables and guarantee the validity of the statistical comparison (Ary et al., 2010, p. 307).

3.10 Statistical Methods and Treatments

To process the raw data and test the study's hypotheses, the researcher utilized the Statistical Package for the Social Sciences (SPSS, Version 26), employing the following techniques:
Descriptive Statistics:
- Mean: To determine the central values of the physical test results for speed components.
- Standard Deviation: To measure the dispersion of the data around their means.
- Skewness: To verify the normality of the statistical distribution and the suitability of the data for parametric testing (Field, 2013, p. 105).
Inferential Statistics:
- Levene's Test for Equality of Variances: To verify the assumption of homogeneity of variance between the two groups prior to conducting comparisons (Field, 2013, p. 343).
- Paired Samples t-test: To detect the significance of differences between the pre- and post-test means within the same group, specifically the experimental group, to evaluate the program's impact (Pallant, 2013, pp. 227-230).
- Independent Samples t-test: To detect the significance of differences between the means of the experimental and control groups in the post-tests for speed components (Pallant, 2013, pp. 237-240).
Effect Size: Cohen's D was calculated to estimate the practical significance of the statistical differences and interpret the magnitude of the effect of the proposed program, moving beyond mere reliance on the p value (Cohen, 1988, p. 20). The effect size is interpreted as small if It is approximately 0.2, medium at 0.5, and large at 0.8 or above.
Level of Significance: The probability level of (p 0.05) was adopted as the threshold for

accepting or rejecting the statistical tests (Gravetter & Wallnau, 2013, p. 232).

4.Results Presentation and Discussion:

This chapter provides a detailed presentation and scientific analysis of the results yielded by statistical processing of field study data. It also encompasses an in-depth discussion and interpretation of these findings in light of the theoretical framework, physiological foundations, and the outcomes of relevant previous studies with the ultimate goal of verifying the proposed hypotheses.

First: Presentation and Analysis of the Results for the Specific Hypotheses Regarding Improvement Within the Experimental Group:

The Effect of a Proposed Educational-Sports Program on Developing Fundamental Speed Components (Sprinting, Reaction, Movement) Among Third-Year Middle School Students in Physical Education and Sports.

Table (2): Significance of differences between the pre-test and post-test for the experimental group (internal improvement) in fundamental speed components.

Variable	Unit	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD	t-value	Sig (p)	Effect Size (Cohen's d)	Improvement %
Shuttle Run Speed	seconds	5.31	0.25	4.89	0.20	8.75	0.000	1.76	7.9%
Reaction Speed	cm	19.8	1.5	16.5	1.3	9.42	0.000	2.00	16.7%
Motor Speed (Frequency)	Count	38.2	2.1	43.5	2.4	-10.11	0.000	2.20	13.9%

(Source: Prepared by researchers, 2026)

Commentary and Analysis of Table (2) Results:

The data in Table (2) clearly demonstrates the existence of highly statistically significant differences ($p<0.001$) between the pre-test and post-test means of the experimental group across all fundamental speed components, in favor of the post-test results. The improvement rate reached 7.9% in sprinting speed, 16.7% in reaction speed, and 13.9% in movement speed.

Furthermore, the effect size values (Cohen's D) confirm this superiority, recording very large values ranging from 1.76 for sprinting speed to 2.20 for the movement speed. This clearly indicates the profound practical significance and substantial impact of the proposed program.

These results strongly suggest that the educational-sports proposed program produced a tangible, positive impact on developing the participants' speed system. This finding fully aligns with modern scientific literature regarding the high efficacy of structured short- and medium-term training interventions in elevating the physical capabilities of youth (Lloyd et al., 2016, p. 1492; Faigenbaum et al., 2016, pp. 160-165).

This remarkable improvement reflects the program's precise ability to target and stimulate the neuromuscular adaptations necessary for accelerating motor performance, achieved through the optimal utilisation of directed exercises and scientific progression of intensity. For instance, the significant improvement observed in reaction speed i(16.7%) can be attributed to the efficiency of the programmed drills in enhancing the quality and velocity of sensory- motor processing within the learner's central nervous system (Weineck, 2011, p. 289).

Second: Results of the Main Hypothesis (Comparison of the Two Groups in the Post-test):

To verify field effectiveness of the proposed educational-sports program compared to the standard curriculum, the significance of the statistical differences between the means of the two groups (experimental and control) in the post-tests were examined for each variable independently, utilising an Independent Samples t-test.

1. Results of the Sprinting Speed Test

Hypothesis Statement: There are statistically significant differences between the experimental and control groups in the post-test of the sprinting speed test, in favor of the experimental group.

Table (3): Significance of differences between the experimental and control groups in the post-test for the sprinting speed variable.

Group	n	Mean	SD	t-value	Sig (p)	Effect Size (Cohen's d)	Significance
Experimental	20	4.89	0.20	-4.88	0.000	1.54	Significant
Control	20	5.23	0.22				

(Source: Prepared by researchers, 2026)

Commentary and Analysis of the Sprinting Speed Test Results (Table 3):

The data from Table (3) clearly demonstrates the existence of statistically significant differences (p<0.001) in favor of the experimental group. Its members recorded a lower

mean time of (4.89 seconds) compared to the control group's mean time of (5.23 seconds), indicating a clear and tangible superiority in sprinting speed. Furthermore, the effect size (Cohen's D) reached a value of (1.54), which is considered very large, confirming the substantial and practical difference between the two groups as a direct result of the training intervention.

This distinct superiority can be attributed to the content of the proposed program, which focused intensively on sprint starts and short sprints from various positions. This effectively contributed to improving neuromuscular coordination and the efficiency of stride mechanics among the experimental group members (Haff & Triplett, 2016, p. 383). This finding aligns with the results of Younes and Bodaoud (2024, pp. 275-288), which confirmed that integrating small-sided games into school classes leads to substantial improvements in acceleration speed. It is also supported by the findings of Luo et al. (2025, pp. 406-452), which demonstrated the superiority of structured training programs over traditional ones in developing the physical capabilities of youth. These physiological and neural adaptations; such as increased propulsion force, reduced ground contact time, and improved inter-muscular coordination, serve as the biomechanical foundation for enhancing sprinting speed (Bompa & Buzzichelli, 2015, pp. 185-187).

2. Results of the Reaction Speed Test:

Hypothesis Statement: There are statistically significant differences between the experimental and control groups in the post-test of the reaction speed test, in favor of the experimental group.

Table (4): Significance of differences between the experimental and control groups in the post-test for the reaction speed variable.

Group	n	Mean	SD	t-value	Sig (p)	Effect Size (Cohen's d)	Significance
Experimental	20	16.5	1.3	5.61-	0.000	1.77	Significant
Control	20	19.4	1.6				

(Source: Prepared by researchers, 2026)

Commentary and Analysis of the Reaction Speed Test Results:

The results in Table (4) indicate a statistically significant superiority (p<0.001) in favor of the experimental group. Its members recorded a lower mean distance in the ruler drop test (16.5 cm) compared to the control group's mean (19.4 cm), reflecting a substantial improvement in visual-motor reaction speed. These repeated stimuli helped reduce "neural latency" and improved the speed of motor decision-making (Bompa & Buzzichelli, 2015, p. 197).

This remarkable improvement can be explained by the fact that the proposed program intensively incorporated small-sided games and specific drills relying on rapid responses to various sudden visual and auditory stimuli. These repeated stimuli helped reduce; and improved the speed of motor decision-making (Bompa & Buzzichelli, 2015, p.197). This finding perfectly aligns with the conclusion of Sun et al. (2025, pp. 1-10) that SAQ training was highly effective in reducing reaction time. It also intersects positively with the observations of Ben Dahina (2019, p. 45-62) regarding the shortcomings of traditional school class content to provide such directed training situations. These profound neural adaptations acquired from the program lead to the accelerated processing of sensory information entering the brain, thereby stimulating motor units in the muscles to execute the response more rapidly and effectively (Schmidt and Lee 2011, p. 205).

3. Results of the Movement Speed Test

Hypothesis Statement: There are statistically significant differences between the experimental and control groups in the post-test of the movement speed test, in favor of the experimental group.

Table (5): Significance of differences between the experimental and control groups in the post-test for the movement speed variable.

Group	n	Mean	SD	t-value	Sig (p)	Effect Size (Cohen's d)	Significance
Experimental	20	43.5	2.4	7.12	0.000	2.15	Significant
Control	20	39.1	2.0				

(Source: Prepared by researchers, 2026)

Commentary and Analysis of Movement Speed Test Results (Table 5):

The results presented in Table (5) demonstrate the existence of highly statistically significant differences ($p<0.001$) in favor of the experimental group. Its members achieved a higher mean number of repetitions in the plate tapping test (43.5 repetitions) compared to the control group's mean (39.1 repetitions). This difference indicates a substantial improvement in movement frequency, and upper limb motor performance speed. Furthermore, the effect size (Cohen's D) reached a value of (2.15), serving as a strong indicator of the very large effect and the high practical efficacy of the proposed program. This tangible improvement reflects the training program's high efficiency in stimulating the neuromuscular system through high-tempo, repetitive, and intensive drills.

This finding is in complete agreement with Faigenbaum et al. (2016, pp. 160-165), who

indicated that integrative neuromuscular training programs effectively contribute to enhancing the central nervous system's capacity to transmit rapid motor signals to the working muscles,
This elevates the quality of explosive and fast performance in youth. Positive development is also attributed to the marked improvement in neuromuscular coordination and the physiological capacity to produce force repeatedly, rapidly, and sustainably (Verkhoshansky and Siff, 2009, p. 38).

General Conclusion:

In light of the preceding results, it can be concluded that the proposed educational-sports program, based on the foundations of modern neuromuscular training and the integration of Speed, Agility, and Quickness (SAQ) drills alongside small-sided games, has proven highly effective in developing the fundamental components of speed (sprinting speed, reaction speed, and movement frequency speed) among third-year middle school students, in comparison to the traditional program adopted in physical education classes.
This effectiveness was clearly manifested through the substantial and statistically significant improvement in the performance of the experimental group members following the program's implementation. Furthermore, the recording of high effect size values confirms the profound practical and field significance of this intervention.
This conclusion affirms that the optimal investment in the developmental characteristics of the 14-15 age group, utilizing standardized scientific programs applicable within the school environment, can generate a qualitative leap in students' physical and motor performance levels without compromising the overarching educational objectives of the subject. Consequently, the outcomes of this study strongly support the modern trend toward incorporating specific, targeted training units within the official curricula of physical education and sports. The impact of this approach is not confined merely to the physiological aspect of enhancing physical capabilities; rather, it extends to reinforcing the psychological and educational dimensions by elevating motivation and fostering the active participation oflearners in sports activities (Davids et al., 2013, p. 167).

5. Recommendations and Suggestions for Future Research:

Based on the results and conclusions derived from this study, the researcher recommends the following:
First, Applied Recommendations (For the Educational Field):

- Adoption of the Proposed Program: It is imperative to integrate the proposed educational-sports program into the instructional units of physical education and sports for middle school students, given its proven and highly reliable effectiveness in developing fundamental speed components.
- Utilization of Small-Sided Games: Emphasize the incorporation of Small-Sided Games (SSGs) and competitive drills as primary pedagogical tools for speed development.

Thisapproach is highly suitable for the psychological characteristics of adolescents and effectively stimulates their intrinsic motivation toward physical activity (Wang 2024, pp. 1-12).

- Scientific Orientation of School Training: Educate physical education teachers on the critical need to transition from random practice methods to structured, targeted training for developing physical traits, particularly by capitalizing on “the sensitive periods” of growth and development, as highlighted in the scientific literature (Lloyd & Oliver, 2012, pp. 61-72).
- Provision of Measurement Tools: Equip educational institutions with simple field measurement tools (e.g., accurate stopwatches, reaction measurement rulers) to enable teachers conduct periodic and objective assessments of students’ physical status and accurately identify their training needs.
- Continuous Professional Development: Organize specialized training courses and workshops for physical education teachers focusing on the latest methodologies in designing and implementing speed training programs, including SAQ drills and integrative neuromuscular training.

Second, Suggestions for Future Studies are provided:

- Conduct similar experimental studies targeting other physical and motor traits (such as explosive power, agility, and speed endurance) among middle school students to evaluate impact of comprehensive training interventions.
- Implement the proposed program on a female sample within the same age group to compare the results and identify gender differences, thereby contributing to the design of training programs that consider the biological specificity of each sex.
- Carry out longitudinal studies to monitor the developmental trajectory of speed and its components among students across successive middle school years, aiming to evaluate the long-term retention and the effects of training programs.
- Analyze the correlational relationship between the improvement in speed components and the level of skill performance in various team and individual sports practiced by students, to understand the functional and tactical dimensions of these improvements.
- Investigate the impact of psychological variables (such as motivation, self-confidence, and physical self-esteem) on students’ responsiveness to the proposed training programs, and evaluate the program’s positive reflections on their psychological well-being.
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