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The effect of using a cognitive reinforcement strategy on improving performance in running (Secondary school students)

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Abstract---The study aimed to identify the role of cognitive motivation in improving running performance among students of the second educational stage. The experimental method was employed, involving two independent groups (experimental and control), with a total sample of 44 students. A comprehensive training program was implemented, combining physical preparation and cognitive development. This program focused on learning to retain execution plans, maintaining concentration, providing feedback, and correcting errors in each instructional situation. The results revealed statistically significant differences in favor of the experimental group between the pre-test and post-test measurements. The study recommended the adoption of cognitive motivation during training to improve performance outcomes, and emphasized the importance of using scientific principles in training and performance in order to properly identify and correct errors.

Keywords---students, combining physical, cognitive development, scientific principles.

Introduction

There is no doubt that human life goes through different stages characterized by internal and external changes, which can be inferred through observation. Continuous influence aimed at improving indicators of positive change must necessarily be subject to well-studied rules and considerations. It is commonly recognized in human societies that they work to teach concepts, ideas, and behaviors related to public life, and to define ways of living across advanced stages of growth—most of which occurs during the school stage.

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From birth, the individual learns a great deal of knowledge and information that enables them to interact with others, including learning language, general information, rules, events, names, and the meanings of symbols, signs, and calls. These are outcomes through which the individual understands what they encounter and overcomes difficulties (Ahmed, 2021, p. 17)

The school is the place or institution responsible for teaching the child various forms of knowledge and sciences, and for guiding their behavior according to the values of the society to which they belong. Educating and guiding students in various motor behaviors and different skills is one of its fundamental tasks, including sports and motor skills such as running, walking, rhythm, and jumping.

Because the part of the brain responsible for movement modifies and readjusts our actions, the brain develops self-regulation and problem-solving skills through repeated activity in the frontal lobe. This continuous repetition of the action, driven by the repeated desire to learn, allows for modification and readjustment of the movement during the motor learning process. Furthermore, brain feedback further activates the learning process. (Siméone, 2024, p. 7)

Motor performance is linked to the nervous system, as stimuli are transmitted to higher neural centers to produce correct responses. This is because the part responsible for The process of recording a situation goes through encoding, then storage, and finally retrieval. Encoding is the transformation of information into a form in which it can be stored, followed by the storage of the encoded information. Retrieval comes in the final stage, during which the stored information is recalled effortlessly in situations where it is needed.

Memory is divided into sensory memory, which receives information from the senses, then passes it to short-term memory, and afterward to long-term memory (Alfat, pp. 120 -121)
Learning refers to a general concept associated with different types, and it indicates improvement in various behaviors. There is cognitive learning and motor learning, among others.
The term *cognition* refers to the psychological processes through which sensory input is transformed, developed, and stored, so that it can later be retrieved in life situations through appropriate stimulation. These psychological processes include perception, memory, imagination, transformation, storage, and thinking. (Hamdi, 2009, p. 27).

Motor learning is related to learning and improving motor skills. Its results appear in the ability to perform and master motor skills and to achieve objectives. It can be developed through training and practice. The senses contribute to sports training and to improving the skill aspect, as they play a major role in acquiring knowledge. The sense of sight, in particular, makes a strong contribution to learning and training, as the learner observes motor models and perceives the performance of the new movement in a general way. In this manner, the learner acquires an initial mental image of its external appearance and observes the important parts of the movement when the motor model is presented. Repeated observation of the model increases performance accuracy and leads to a high level of retention (Mazen, p. 135).

"The eye creates a kind of balance: when the learner sees the movement presented in front of them, they go through a stage of comparison between what they see displayed and what they feel in terms of their energy and ability to perform that movement, attempting to imitate it in order to satisfy their inner desires and motivations as a result of observing the model presented before them" (Abdul-Majid., 2002, p. 96)

The importance of the sense of sight is represented in receiving stimuli emitted from educational devices or from the teacher themselves, as well as in the use of instructional aids.
"The importance of the visual sense lies in benefiting from the use of visual aids that support learning, such as using video recording of performance and replaying it, as occurs in training sessions and sports

matches. It may also include presenting a movement model performed by a person who masters the performance, so that the receiver forms an initial mental image of the skill. Static visual presentation (visual stimuli in the form of images) and correcting deficiencies through watching instructional videos are also effective methods" (Khoja, 2012, p. 99)

Hearing plays a major role in human development, as the sense of hearing enables humans to learn language and is a fundamental factor in the development of social behavior. It also helps individuals understand their environment and recognize existing dangers in order to avoid them. (Al-Khatib JamaL & Mona Sobhi, 2009, p. 130)

The auditory system plays a role in receiving auditory stimuli and signals and transmitting them to the brain to be recognized and perceived. Thus, we find diversity in the concept of auditory stimuli. Hearing also receives the teacher's instructions to the learner in educational situations in the form of verbal explanations, which guide the learner and correct their motor performance, or are delivered through instructional aids to develop motor abilities and motor performance.

Due to the importance of sensory integration in the learning and motor learning process, integrated performance results from the simultaneous functional interaction of the senses of hearing, touch, and sight. A person cannot learn a skill through verbal explanation alone or through vision alone.
Teaching sports skills and various movements has become subject to different considerations depending on their objectives, which necessitates the diversification of teaching and training strategies. Traditional methods are often used in the learning process to instruct skills and improve physical performance.

The number of hours allocated to physical education does not correspond to the established objectives, and it is not possible to achieve significant results in changing the learner's skill and physical level. Therefore, the use of cognitive reinforcement during physical practice is one of the important means capable of bringing about that positive change in the educational and training level. Cognitive stimulation is related to the process accompanying the practice of physical education through the provision of cognitive and theoretical guidance by explaining energy supply systems and the process of effort distribution in accordance with the nature of training fields and the pedagogical tools used. This also includes providing auditory and visual cognitive stimuli to enhance students' understanding of the mechanical and biomechanical properties of movement. Therefore, running a middle-distance race requires a good understanding of how to distribute energy capacities in order to complete the distance without experiencing acute fatigue, while maintaining high levels of attention. Maintaining a high level of attention increases neural stimulation of muscle groups, thus achieving a high pace and appropriate acceleration. It is undisputed that knowledge is cumulative; therefore, each training session should include adequate cognitive guidance specific to those exercises or learning tasks so that they are consolidated in memory.

Motor skills vary according to individual needs: basic movement skills; locomotor skills such as walking and running; non-locomotor skills that involve moving a body part, such as kicking a ball without changing body position; and manipulative skills related to the use of equipment, such as using a racket in tennis. (Hussein Talha & a, (2006))
The cognitive guidance strategy in sports performance for middle-distance running is based on a set of elements, including:

Planning of motor performance:
This component focuses on obliging the learner to develop a mental plan that enables achievement and overcoming the difficulties of the stage without losing concentration, while being aware of their physical level and avoiding relaxation. This includes adopting gradual progression in performance,

monitoring race pace, maintaining general motor coordination, and ensuring neural coordination to benefit from the biomechanics of the body's moving limbs.

Concentration and attention:
Maintaining the longest possible commitment to instructions and applying them, such as avoiding talking during running to preserve respiratory efficiency, maintaining visual and auditory attention, and minimizing external distractions that reduce the responsiveness of the working muscles.

Feedback:
Improving performance by referring back to the information adopted in the planning phase, correcting errors, or improving the plan developed for executing the motor performance.

Improving Physical Capacities:
The success of cognitive guidance for the learner and the application of its elements require a certain level of respiratory efficiency, muscular strength, and flexibility. All of these enable the runner to implement their plans with focus and attention, along with correction and critique.

Process of Implementing the Cognitive Guidance Plan to Improve Performance:
The instructional unit always begins with welcoming the learners and presenting the element to be improved. This is followed by the general and specific warm-up process, consisting of a set of physical exercises and sensorimotor exercises. Physical exercises include running, limb mobilization, strength development, and speed exercises. Sensorimotor exercises involve activating attention and improving correct reaction responses, such as reverse-signal drills and standing–sitting exercises according to a specific cue to increase correct responses, as well as external and internal feedback.
The learner then performs the skill, after which the teacher's role is to observe the degree of adherence to the guidance elements, the level of plan implementation, the level of attention, and its effects.
Training units are carried out while adhering to the strategy, since motor performance is primarily a learning process first and a physical process second.
While working on the specific objective (maintaining performance capacities in the 800 m run), a plan is established to achieve focus by maintaining a high level of attention and managing the track without losing speed. Running is performed with free coordination and sensorimotor harmony, while maintaining body alignment, with adjustments in movement form according to curves and straight sections of the track. After completion, the stage of providing external feedback follows by selecting the best performance, viewing it collectively, correcting errors, and relying on internal feedback, then proposing questioning activities to consolidate performance.
Improving a runner's speed and technical performance requires dividing training into instructional units, each conducted using the same strategic approach. Maintaining this pattern represents an addition to traditional methods of teaching physical education and sport, and contributes to raising the technical and physical level of the athlete.

Therefore, the following question can be raised:
Does the use of cognitive reinforcement play a role in improving running performance among secondary school students?
Partial Research Questions

- There are no statistically significant differences in the pre-test measurements between the two groups in the running test.
- Are there statistically significant differences between the pre-test and post-test for the experimental group?
- Are there statistically significant differences between the pre-test and post-test for the control group?
- Are there statistically significant differences in the post-test measurements between the two groups?

General Hypothesis:

- The use of cognitive reinforcement plays a role in improving performance in running among high school students.

Sub-Hypotheses:

- There are statistically significant differences between the pre-test and post-test for the experimental group.
- There are statistically significant differences between the pre-test and post-test for the control group.
- There are statistically significant differences in the post-test measurements between the two groups.
- there Are statistically significant differences in the post-test measurements between the two groups

Research Objectives:

- To highlight the effective role of the informational aspect in physical education lessons.
- To identify the role of cognitive reinforcement in improving running performance.
- To strengthen the relationship between cognitive processing and correct motor response.
- To engage mental processes such as memory and planning in training and preparation to achieve results.

Significance of the Study:

Sports and physical activity in the school environment have scientific, psychological, and physical benefits, as they provide an opportunity to address motor dysfunctions. They support the positive cognitive aspect and enhance mental and physical abilities. This study is important for improving sports outcomes; therefore, it was conducted to investigate the role of cognitive reinforcement in improving the athletic performance of high school students.

Previous and Related Studies

Study by Ahmed Adam Ahmed Mohamed: *The Effect of Using Verbal Reinforcement on Learning Some Basic Football Skills for Secondary School Students in Khartoum State.*
The study aimed to examine the effect of teaching units for some basic football skills using verbal reinforcement on a sample of 60 secondary school students. The experimental method with two equivalent groups was used, one of which underwent the program. The study concluded in the post-test that verbal reinforcement had a significant effect, showing differences between the two groups. (AHMAD ADAM, 2006)

Study by Anna-Liisa Kyhälä: *Physical Activity and the Quality of the Learning Environment in Finnish Preschools.*
The study aimed to determine the level of interaction of children with planned and structured physical activities provided by teachers, which were found to be better than traditional activities. This led to an increase in students' motivation and desire to participate. (Anna-, Jyrki, & Heikki, 2012)

Study by Hilary Sweatman: *Development of the Neural Correlates of Recollection.*
This study focused on finding the relationship between levels of recollection in two groups: younger and older children. It found a difference in recollection levels favoring older children, highlighting the need to activate brain lobes and enhance memory. (Hilary & AL, 2022)

Study by Ali Jawadi: *Motivation and Its Relationship to the Performance of Handball Club Players During Sports Competition.*
The study examined the level of motivation, both material and moral, among handball club players in the first division, as well as the relationship between motivation and players' performance during competitions. The sample consisted of 45 players. The study relied on a motivation scale and a performance scale. Results showed that material incentives were provided to a large and sufficient

degree for handball players, while moral incentives were provided to a moderate degree. The study concluded that there is a statistically significant correlation between both material and moral motivation and performance during competition among handball players (ALI & KHALED, 2019)

Study by Fadi Farid Abu Sultan: *The Effectiveness of Using Educational Video Games in Developing the Side Punch Skill in Boxing*
The study aimed to investigate the effectiveness of using educational video games in developing the side punch skill in boxing among students of the Faculty of Physical Education. A quasi-experimental design was employed, and an observation checklist was applied to measure the side punch skill in boxing for the study sample. The results showed an improvement in the side punch skill in boxing in favor of the post-application measurement. It was also found that using educational video games to develop the side punch skill in boxing achieved greater effectiveness. (FADI, 2023)

Study by Hossam El-Din Abbabaseh: *Cognitive Achievement Level and Its Relationship with Some Physical Attributes among Young Karate Practitioners*
The study aimed to identify the nature of the relationship between cognitive achievement and some physical attributes (flexibility, agility, and transitional speed) in karate using a descriptive correlational method on a group of 20 players. The researchers also used a cognitive achievement test for the basic skills in karate and found a correlational relationship between high levels of cognitive achievement and certain physical attributes. The study recommended conducting cognitive tests during the selection process. (Abbabaseh, 2023)

Discussion of Previous Studies:
Based on the mentioned studies that explored aspects of learning and the key factors affecting learning and skill acquisition, cognitive reinforcement was applied to improve results. Learning is a mental process that occurs in active regions of the brain, highlighting its role in learning. Increasing activation and enhancing motivation contributed to improved outcomes. Cognitive learning in sports passes through sensory receptors, particularly auditory and visual, and the use of educational videos enhances learning and supports correct performance. A good level of cognitive achievement in a particular sport correlates with improved performance.

Therefore, our study aims to utilize the educational process to enhance sports performance. Physical activity is a neural activity connected to the brain and does not occur outside it. Exploiting the relationship between sensory knowledge and its processing in the brain leads to improved motor performance, which is manifested through motor behaviors.
It reflects the level of brain activity and the role of the physical education teacher in enhancing cognitive achievement, which in turn affects the improvement of skill performance in various individual sports, most of which require running.

Research Terms:

Cognitive Stimulation: An educational and training strategy that relies on reinforcing the cognitive aspect of techniques, plans, and the distribution of abilities by providing individuals with information about the movement, consolidating it in memory, and applying it by continuously tracking deviations and correcting them.
Sports Performance: The achieved accomplishment, particularly regarding the level of skill mastery and attaining field results.
High School Students: The age group between 15–19 years, representing the stage before university specialization, characterized by receiving diverse knowledge, including knowledge related to sports.

Methodological Procedures:

Methodological Approaches Used in the Study:
Exploratory Study: A preliminary study conducted by the researcher on elements of the research sample to identify the availability of tools, resources, and suitable conditions for applying the study, as well as selecting the appropriate sample.

Research Fields:
Spatial Field: The study was conducted on a sample of high school students, where the training program was applied.
Temporal Field: The research was conducted during 2025.

Research Method Used:
The experimental method was employed due to its suitability for studying the level of improvement in performance results through pre-test and post-test measurements.
Research Population: The research population consisted of high school students.
Research Sample: The sample was selected purposively, consisting of 44 students, divided into an experimental group that underwent the program and a control (observational) group that followed the regular study.

Research Variables:
A variable is defined as the element whose effect or role the researcher aims to prove in achieving results.

Independent Variable:
This is the factor whose impact the researcher wants to measure in the studied phenomenon. In our research, it is **cognitive stimulation guidance**.

Dependent Variable:
This is the outcome resulting from the effect of the independent variable on the phenomenon. In this study, it is the **800-meter race**.

Study Tools:
Field tests were used to verify the effect of the independent variable:

- Running test (800 m) – speed.
- Observation checklist.
- Speed recording device.
- A special recording card for each participant.

Statistical Methods Used:
After collecting the results and organizing them in tables according to each studied sample, the data were processed statistically using:

- **Student's t-test** for two related samples.
- **Pearson correlation test** to measure the correlation between two variables.
- **SPSS software** for processing test results.

Validity:
The validity of the test is considered one of the main factors determining the suitability of the test. The validity coefficient of the two tests was determined through **test-retest application** and using **Pearson correlation** to measure the relationship between the first and second measurements after a period of time from the first measurement.

Reliability:
The reliability coefficient of the two tests was extracted after reapplying the test and determining the correlation value between the results of the first and second applications, indicating the consistency of the tests and their suitability. It reflects the repeated consistency of results on the same individuals.

Validity Coefficient	Reliability
0.009	0.98

Measurement | Mean | Standard Deviation
Age | 17 | 1.25
Height | 1.65 | 1.01

Analysis and Discussion of Results:

Table (03): Comparison of Pre-Test Means for the Two Groups

Variable	Pre-Test	Sample Size	Mean	Standard Deviation	Degrees of Freedom	Calculated t	Tabular t	Significance Level	Significance
Running Test	Experimental	22	1.75	0.43	42	1.19	1.68	0.05	Not Significant
	Control	22	1.60	0.28					

From Table (03), which shows the mean of the running test in the pre-test, the experimental group had a mean of 1.75 with a standard deviation of 0.43, while the control group had a mean of 1.60 with a standard deviation of 0.28. The calculated Student's t-value was 1.68, which is equal to the tabular t-value of 1.68 at a significance level of 0.05. This indicates that there is no statistically significant difference between the two pre-test measurements.

Table No. (04): Comparison between Pre-test and Post-test Results for the Control Group

Variable	Test	Sample Size	Mean	Variance	Standard Deviation	Degrees of Freedom	t-calculated	t-critical	Significance Level	Significance
Running Test	Pre-test	22	1.75	15.15	0.43	32	2.18	2.07	0.05	Statistically Significant
	Post-test	22	1.50	13.09	0.31					

From **Table No. (04)**, which shows the mean in the Running Test for the pre-test (1.75) with a standard deviation of (0.43), and the post-test mean (1.50) with a standard deviation of (0.31), the calculated t-value was (2.18) while the critical t-value was (1.68) at a significance level of 0.05. This indicates a statistically significant difference between the two tests in favor of the post-test.

Table No. (05): Comparison of Post-test Results for the Control Group

Variable	Pre-Test	Sample Size	Mean	Standard Deviation	Degrees of Freedom	Calculated t	Tabular t	Significance Level	Significance
Running Test	Experimental	22	1.60	0.28	42	0.76	1.68	0.05	Not Significant
	Control	22	1.53	0.32					

From **Table No. (05)**, which shows the mean in the Running Test for the pre-test (1.60) with a standard deviation of (0.28), and the post-test mean (1.53) with a standard deviation of (0.32), the calculated t-value was (0.68) while the critical t-value was (1.68) at a significance level of 0.05. This indicates no statistically significant difference between the two tests.

Table 06: Comparison of Means in the Post-Test Measurement for the Experimental and Control Groups

Test	Measurement	Sample Size	Mean	Standard Deviation	Degrees of Freedom	Calculated t	Tabulated t	Significance Level	Significance
Running Test	Experimental	22	1.50	0.31	42	0.23	1.68	0.05	Not significant
	Control	22	1.53	0.32					

From Table 06, which shows the post-test mean for the running test in the experimental group (1.50) with a standard deviation of (0.31), and the mean for the control group in the post-test (1.53) with a standard deviation of (0.32), while the calculated Student's t-value was (0.23) and the tabulated t-value was (1.68) at a significance level of 0.05, the result is statistically **not significant**, indicating no meaningful differences between the two groups.

Monitoring Performance Levels %

Table 07: Percentage of Applying the Cognitive Stimulation Strategy Components

Sample	Planning and Execution	Performance Retention	Focus
22	50	60	70

From Table 07, it is observed that the control group during the measurement achieved percentages in applying the strategy as follows: 50% in planning, 60% in performance retention, and 70% in focus during performance.

Discussion of Results

From the previous results, it is evident that in the first measurement, there were no statistically significant differences between the two groups. However, after implementing the program, significant differences were recorded between the two measurements for the experimental group following the cognitive stimulation program.

No differences were observed between the two measurements for the control group. Additionally, no statistically significant differences were found in the post-test measurements between the two groups, although there were slight differences in the means favoring the experimental group.
Percentage values were also recorded across the axes of the cognitive stimulation strategy.
It can be stated that improving running performance in middle-distance races is a complex process involving both physical and mental aspects (the nervous system) through the use of cognitive stimulation. This is because runners in these events require both physical and mental preparation, which aligns with the findings of previous studies.

The results of Labchiri (2018) indicated the role of mental imagery in improving certain physical and skill abilities in volleyball. The study confirmed that mental imagery contributes effectively during the physical and tactical preparation phase. (Ahmed, 2018)
This is because sprinters in speed events, in order to achieve good results and record high performance, need a full level of neuro-mental readiness. This readiness is represented in the process of receiving stimuli and signals through sensory sources—visual, auditory, or combined—and then processing them to issue the correct response. This is especially important because runners compete in fast-paced events

that do not allow time to choose solutions. Therefore, prior knowledge is required on how to surpass opponents and identify acceleration zones while maintaining full motor capabilities throughout performance, which is referred to as **performance reflection**.
Mazari (2020) demonstrated that training planning is a preliminary process that allows the development of mental representations and future plans to predict performance and reduce the chances of failure (MezarI & Dahmani, 2020)
Accordingly, the program included practices that required preparing a plan to achieve good results during training sessions

Overcoming Obstacles:
Maintaining consistent responses requires continuous reinforcementTherefore, continuous clarification was emphasized in each training session, highlighting that achieving athletic results requires maintaining the same response. This was achieved by alternating between increasing acceleration and maintaining it, depending on the movement path. When the path is straight, acceleration needs to be increased by enhancing limb movement and preserving overall coordination. In cases where the path changes, improved visuomotor coordination is required to avoid losing the stimulus, which could lead to slowing down and incorrect responses that negatively affect performance outcomes.
Studies indicate that information is collected in the brain, which selects what is appropriate for the situation; it is involved in decision-making rather than executing the decision . (Awad & Maher, 2029, p. 05)

Team sports involve planning and organizational aspects, which are also linked to brain functions. Individual sports require planning and acquiring skills related to managing phases of running and distributing effort, with the brain contributing to maintaining balance and motor coordination between senses and muscles—from receiving stimuli to producing responses—similar to what happens with runners when surpassing competitors.

Conclusions and Recommendations

- Training programs should be planned to develop both physical and cognitive abilities under the same training conditions.
- Improving results and performance requires well-established mental consolidation of information.
- The role of the senses must be considered, as they are the body's input for correct information and performance.
- Building initial mental representations of movement requires both verbal knowledge and visual observation.
- Physical education teaching methods should be diversified between practical training and cognitive stimulation in motor and sports situations.
- Mastery requires retaining various skill components.

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