Scientific journal of physical and sports education(RSEPS)
(ISSN): 1135-1111 / EISSN 2661 - 7358
https://www.asjp.cerist.dz/en/PresentationRevue/452

Volume: 25/ N°: 01 (2026), p 35-48

An Evaluative Study of Swimmers (Freestyle and Breaststroke) Under 12 Years of Age

Dr. Smara Mohamed[1]
University of Mohamed-Chérif Messaadia, Souk Ahras – Algeria
m.smsrs@univ-soukahras.dz

Received: 25/08/2025 **Accepted: 11/12/2025**

Abstract:

This study examined the effectiveness of a developmental training program on a sample of 15 swimmers aged 9–11 years from Wefaq Club in Taoura. The program was designed to enhance fundamental skills while considering the functional, motor, and psychological characteristics of this age group.

Data collection relied on physical tests measuring motor coordination, breathing, distance covered, and performance level, The findings showed that the program significantly improved performance in freestyle swimming, particularly in coordination, breathing, and distance covered, as well as execution speed in both freestyle and breaststroke. However, its effect on coordination and breathing in breaststroke swimming was limited.

Keywords: Swimming; Motor coordination; Breathing; Distance covered; Age group under 12 years.

Article info

[1] *Dr. Smara Mohamed*

1. Introduction:

Swimming stands as one of the most complete and beneficial physical activities, combining health promotion, physical conditioning, and psychological well-being with recreational and competitive value. Unlike land-based movements, swimming demands the acquisition of specialized motor skills—floating, breathing control, and coordinated propulsion—that require structured, progressive instruction.

Early engagement in swimming, particularly during childhood, plays a pivotal role in developing motor coordination, muscular strength, and cognitive abilities, while fostering adaptability to aquatic environments. Beyond its athletic dimension, swimming serves as an effective tool for rehabilitation, injury prevention, and lifelong fitness.

This study investigates pedagogical approaches to developing fundamental aquatic skills in children aged 9–11 and examines their impact on mastering advanced swimming techniques, aiming to provide evidence-based guidelines for optimizing training methods in sports education.

2. Research Problem:

- Are there statistically significant differences between the pre-test and post-test results in skill-based tests and distance covered among swimming athletes?

Based on this main question, the following sub-questions are posed:

- Are there statistically significant differences between pre-test and post-test measurements in motor coordination skill (freestyle swimming) in favor of the post-test?
- Are there statistically significant differences between pre-test and post-test measurements in distance covered (freestyle swimming) in favor of the post-test?
- Are there statistically significant differences between pre-test and post-test measurements in motor coordination skill (breaststroke swimming) in favor of the post-test?
- Are there statistically significant differences between pre-test and post-test measurements in distance covered (breaststroke swimming) in favor of the post-test?

3. Research Objectives:

- To assess the performance level of swimming athletes at the Wifak Sports Club for Swimming in Taoura Municipality.
- To evaluate the training program of the club's coach and provide both scientific and practical contributions.
- To attempt an assessment of the preparedness level of swimming facilities.

4. Significance of the Study:

This study derives its significance from multiple scientific and practical dimensions. Academically, it enriches specialized knowledge in the field of sports training, particularly in swimming, by highlighting the effectiveness of training programs in improving athletes' physical and technical performance. This is achieved through the comparison and statistical analysis of pre- and post-test measurements, providing accurate and reliable indicators.

From a practical standpoint, the study offers a methodological tool for coaches and specialists to scientifically evaluate and adjust their training programs to meet athletes' needs, thereby enhancing overall efficiency and performance. Furthermore, the adopted methodology serves as a model for designing similar programs for other sports or different age groups.

5. Research Hypotheses:

5.1. General Hypothesis:

- There are statistically significant differences between pre-test and post-test results in skill-based tests and distance covered among swimming athletes.

5.2. Specific Hypotheses:

- There are statistically significant differences between pre-test and post-test measurements in motor coordination skill (freestyle swimming) in favor of the post-test.
- There are statistically significant differences between pre-test and post-test measurements in distance covered (freestyle swimming) in favor of the post-test.
- There are statistically significant differences between pre-test and post-test measurements in motor coordination skill (breaststroke swimming) in favor of the post-test.
- There are statistically significant differences between pre-test and post-test measurements in distance covered (breaststroke swimming) in favor of the post-test.

6. Important Terms in the Research:

6.1. Swimming:

- Linguistic Definition: In Arabic, the word "swimming" (from sabaha) means to move or float in water or air. It is said: "He swam in water" meaning he floated or moved through it. (Ibn Manzur, Lisan al-Arab, Dar Sader, Beirut, 1990, Vol. 7, p. 214).

- Terminological Definition: Swimming is a sport activity that relies on organized movements of the limbs and body, enabling the individual to float and move in water efficiently and at speed. (International Swimming Federation, FINA Handbook, 2021, p. 33).

- Operational Definition: In this study, swimming refers to the skillful performance of the four main strokes (freestyle, breaststroke, backstroke, butterfly) within a defined distance in a swimming pool during training or competition.

6.2. Motor Coordination:

- Linguistic Definition: “Coordination” originates from the Arabic root nasq, meaning to arrange or organize. “Movement” (haraka) refers to the opposite of stillness, i.e., the transition from one state to another.(Ibn Manzur, Lisan al-Arab, Dar Sader, Beirut, 1990, Vol. 10, p. 332).

- Terminological Definition: Motor coordination is the ability to regulate the function of muscles and nerves so that sports movements are performed harmoniously with spatial and temporal accuracy. (Schmidt, R. A., & Lee, T. D., Motor Control and Learning, Human Kinetics, 2019, p. 215).

- Operational Definition: In this study, motor coordination refers to the swimmer’s ability (under 12 years old) to perform technical swimming movements (arms, legs, breathing) with correct timing and integration.

6.3. Distance Covered:

- Linguistic Definition: In Arabic, “distance” refers to the span between two points, while “covered” refers to what has been traversed or completed. (Ibn Manzur, Lisan al-Arab, Dar Sader, Beirut, 1990, Vol. 6, p. 412).

- Terminological Definition: Distance covered is the length of the path an athlete travels while performing a specific activity, usually measured in meters or kilometers.(Hay, J. G., The Biomechanics of Sports Techniques, Prentice Hall, 1993, p. 98).

- Operational Definition: In this study, distance covered refers to the number of meters swum from the start point to the finish line in the pool (e.g., 25 m, 50 m).

6.4. Age Group under 12 Years:

- Linguistic Definition: In Arabic, “group” refers to a set of people, and “age” refers to the duration of a human’s life. “Under 12 years” denotes those who have not yet completed twelve years. (Ibn Manzur, Lisan al-Arab, Dar Sader, Beirut, 1990, Vol. 15, p. 114).

- Terminological Definition: The age group under 12 years refers to children athletes aged between 6 and 11, representing a critical developmental stage in physical education. (Malina, R. M., Bouchard, C., & Bar-Or, O., Growth, Maturation, and Physical Activity, Human Kinetics, 2004, p. 145).

- Operational Definition: In this study, the age group under 12 refers to male and female swimmers who do not exceed 11 years and 11 months at the time of the experiment.

7. Previous and Similar Studies:

7.1. Study by Amara Nour Eddine, Habbara Mohamed, and Saghiri Rabah Published in Journal of Sports Creativity, Issue 10, 2013, University of M'sila, entitled: **"Evaluation and Assessment of First-Year Common Core Students in the Swimming Module (Freestyle) at the Institute of Physical and Sports Activities Sciences and Techniques, University of M'sila."**

Study Objectives:

- Assist learners in fully and correctly acquiring the movement or skill.
- Support the development of motor skills.
- Facilitate the learning of difficult skills.
- Help achieve a faster rate of movement performance.

Methodology: The descriptive method was adopted due to its suitability for the nature of the study.

Population and Sample: The study sample consisted of 30 first-year LMD students, selected from the original population of all first-year LMD students in the academic year 2012–2013.

Main Findings:

- The need to reconsider the allocated time for teaching the swimming module for first-year common core students, currently set at one semester, totaling approximately 15 sessions.
- The necessity of providing appropriate facilities for the teaching and training process of the swimming module.
- The provision of pedagogical equipment and materials to facilitate the teaching process for both instructors and students.

7.2. Study by Djaballah Khaled, Zebchi Nour Eddine, and Taj Mohamed Published in Journal of Sports Performance Sciences, Vol. 2, No. 1, June 2020, entitled: **"The Effect of Hypoxic Training in Swimming on Improving Certain Physiological Variables and Swimming Skills in Children with Asthma Aged 12–14 Years."**

Study Objectives:

- Determine the effect of hypoxic swimming training on breath control in water, peak expiratory flow, and breath-holding time in children with asthma.
- Examine the impact of hypoxic swimming training on learning certain swimming skills in children with asthma.

Methodology: The experimental method was applied.

Sample: Ten male children with asthma, aged between 12–14 years.

Main Findings:

- Statistically significant differences in favor of the post-tests in the breath-holding test, indicating the effectiveness of the hypoxic training program.
- Statistically significant differences in favor of the post-tests in the peak expiratory flow test, confirming the program's positive effect.
- Statistically significant differences in favor of the post-tests in the in-water breathing test, demonstrating the impact of hypoxic training.

7.3. Study by Maytham Mohsen and Ghaith Mohamed Kareem Published in Journal of Research in Physical and Sports Activities Sciences and Techniques, Vol. 4, No. 5, 2023, entitled: **"The Effect of a Water Games Program on Learning Freestyle Swimming Skills for Beginners Aged 8–9 Years."**

Study Objectives:

- Develop a water games–based program to teach freestyle swimming skills to beginners aged 8–9 years.
- Identify the effect of the water games program on learning freestyle swimming skills for beginners aged 8–9 years.

Methodology: The researchers employed the experimental method with equivalent groups.

Population and Sample: The research population consisted of beginner children who could not swim, aged 8–9 years, from a center in Babil Governorate. The total number was 30 beginners. The sample was randomly selected from the population and consisted of 20 children, divided equally into an experimental group and a control group (10 in each). The sample thus represented 66.66% of the research population, deemed adequate and representative for the study's purposes.

Main Findings:

- The use of the water games–based program proved effective in developing basic freestyle swimming skills in beginner children, enhancing motor coordination, and promoting smooth, balanced movement in water.
- The engaging nature of water games reduced fear and anxiety toward the aquatic environment, created a sense of familiarity, fun, and encouragement, and motivated children to engage and persist in learning swimming.
- The use of age-appropriate educational tools (for ages 8–9) played a significant role in facilitating the learning process, attracting children's attention, and improving their understanding and motor application in a simple and effective manner.

8. Research Methodology:

Based on the research problem, which investigates the differences in improving breaststroke and freestyle swimming performance among competitive swimmers, the researcher adopted the **experimental method**, as it aligns with the nature of the study—a training program evaluation. This method allows for measuring the effect of a specific condition or factor on a given phenomenon after a certain period. (Mohamed Zian, 1983, p. 117)

9. Research Population and Sample:

9.1. Population: All swimming clubs operating in the semi-Olympic pool of the Taoura district.

9.2. Sample: The research sample consisted of 15 swimmers from the *Wifak* team, under 12 years of age, selected randomly.

10. Exploratory Study:

10.1. Phase One – Objectives:

- Identifying potential problems and challenges the researcher may face when assessing the coach's experimental program.
- Evaluating the suitability and accuracy of measuring instruments and tools.
- Training the research team.
- Estimating the time required to perform the tests.

10.2. Phase Two:

During this stage, the research tests were applied and repeated after four days. The purpose of this pilot phase was to determine the validity and reliability coefficients of the research tests.

11. Experimental Variables:

11.1 Independent Variable: The coach's training program.

11.2 Dependent Variables: Freestyle swimming and breaststroke swimming.

11.3 Controlled (Intervening) Variables: These refer to ensuring equivalence between the experimental groups in variables that may influence performance levels, such as skill level, height, weight, years of experience, and others (Mohamed Hassan Allawi & Osama Kamel Rateb, 1999, p. 223).

11.3.1 Experimental Control: This includes all efforts made to eliminate the effect of any variable—other than the independent variable—that may influence the dependent variable. In this study, factors such as height, weight, and age were statistically accounted for to ensure homogeneity between the groups. Additional factors were also considered, such as the number of training sessions and the experience and competence of coaches who had worked with the team throughout different age stages.

12. Research Difficulties:

- Lack of accurate and rigorous references and scientific works related to the topic.
- Shortage of pedagogical tools specific to the practical aspect.

13. Scope and Limits of the Field Study:

13.1. Human Scope (Research Sample):

The sample of participants targeted in the study consisted of swimmers from the sports association *Al-Wefaq* (Taoura District), under the age of 12, specializing in swimming, during the 2024–2025 training season.

13.2. Time Scope:

The pilot study for the pre-tests was conducted on **February 5, 2025**, while the post-tests were conducted on **February 12, 2025**.

The main study was carried out from **February 20, 2025** to **March 30, 2025**.

13.3. Place Scope:

All pre- and post-tests for both the pilot study and the main study were conducted at the team's training venue (*the semi-Olympic swimming pool*), Taoura District, Souk Ahras Province.

14. Research Tools:

The results obtained are closely related to the methodology and tools used in the data collection process. The tools used in the study include a set of instruments, methods, and procedures applied to collect and analyze data, namely:

14.1. Arabic and Foreign References and Online Resources:

Books and encyclopedias, theses and dissertations, and online websites.

14.2. Measuring Devices Used in the Study:

- Stopwatch (timer) to measure time.
- Medical scale.
- Stadiometer (sliding caliper) for measuring height.
- Other measurement-related devices.

14.4. Forms:

- Expert opinion survey form for determining physical and motor skill tests.

14.5. Measurements and Tests Used in the Study:

14.5.1. Anthropometric Measurements:

Based on the analysis of the content of references and scientific studies, some anthropometric measurements were used to express the physical appearance of the body as a data collection tool, including:

- Standing height (in centimeters).
- Body weight (in kilograms).

14.5.2. Physical Tests:

- Coordination test.
- Breathing test.
- Distance covered.

15. Scientific Foundations of the Tests:

15.1. Test Reliability:

Test reliability refers to the ability of a test to accurately measure the phenomenon or trait it was designed to assess (Laila El-Sayed Farhat, 2007, p. 143). It is defined as producing the same results when repeated with the same individuals under the same conditions (Nabil Abdel-Hadi, 1999, p. 66).

The reliability coefficient for the tests in this study was determined using the **test–retest** method. The tests were applied to a random sample of 8 swimmers from the research sample. After four days, the same tests were reapplied to the same group under identical conditions, and Pearson's simple correlation coefficient was used.

- Physical Tests:

Table 01: Shows the reliability coefficient values of the physical tests.

Tests		Preliminary Exploratory Experimental Sample					
		test		**retest**		**Test "r"**	**Self validity**
		mean	**Standard deviation**	**mean**	**Standard deviation**		
Breaststrocke	**Strock coordination**	10	1.265	9.66	0.816	0.775	0.880
	Breathing technique	8.66	1.633	9.33	1.633	0.793	0.890
	Speed and performance	9	1.633	9	1.095	0.7	0.836
freestyle	**Strock coordination**	9	1.63	9.33	1.095	0.896	0.946
	Breathing technique	9.67	1.504	9.67	0.816	0.543	0.736
	Speed and performance	9.33	1.03	10	1.26	0.616	0.784

From **Table 1**, it is evident that all **Pearson correlation coefficients** (reliability) range between **0.54 and 0.89**, with self-validity coefficients ranging between **0.74 and 0.94**. These results indicate that the tests used in this study possess strong reliability and validity.

15.2. Test Validity:

Although the tests used in the study have validity coefficients reported in many previous studies, we determined two types of validity in the present work:

First: Self-Validity:

The researcher calculated the square root of the reliability coefficient. Table (1) present these results.

15.3. Objectivity:

A test is considered objective if it yields the same score regardless of the scorer (Fatima Awad Saber,

2003, p. 164). Accordingly, we conducted a series of simple and clearly defined tests, explained in detail with all requirements and procedures. We also used the necessary tools and methods while maintaining consistent timing and execution procedures.

16. Description of Measurement and Test Protocols:

16.1. Anthropometric Measurements:

16.1.1. Standing Height (cm):

Height is the distance between the soles of the feet and the highest point of the head while the subject stands upright, arms relaxed at the sides. The measurement is taken using a **sliding stadiometer (toise)** in centimeters. The device consists of a vertical rod fixed to the edge of a wooden base (250 cm in height, with zero at the base level) and a horizontally movable headpiece.

The subject stands on the wooden base with their back against the vertical rod, touching it at three points: the area between the shoulder blades, the most protruding point of the buttocks, and the calves. The subject must fully extend the body upward while looking straight ahead. The headpiece is lowered to touch the crown of the head, and the reading at the headpiece corresponds to the subject's height.

16.1.2. Body Weight (kg):

Body weight is one of the simplest anthropometric measurements, though it can be subject to error if inappropriate devices are used. Using a **medical scale**, the subject stands in a position that allows them to read their weight. The examiner records the value displayed on the screen, rounding to the nearest 50 g.

16.2. Physical and Skill Tests:

16.2.1. Coordination Test:

16.2.2. Breathing Test:

16.2.3. Speed and Performance Test:

— Physical and Skill Test Protocol —

Objective:

To assess the harmony and synchronization of various movements (arms, legs, breathing) and performance speed during swimming.

Warm-up:

5 minutes of light swimming followed by simple stretching exercises.

25 m Maximal Speed Swim:

The swimmer performs a 25-meter swim at maximum speed, maintaining a natural movement pattern. Changing the swimming style during the test is not allowed. Observations are recorded by the coach or through video analysis.

Evaluation Criteria:

- Arm coordination
- Leg coordination
- Breathing synchronization
- Overall movement fluidity

17. Main Study:

17.1. Research Sample:

17.1.1. Experimental Group:

The experimental group in this study underwent a training program designed by the coach, consisting of **16 training sessions**, with each session lasting **1.5 hours**.

17.2. Group Equivalence:

According to Shadish, Cook, and Campbell (2002), group equivalence—ensured through randomization—is essential to attribute any differences solely to the experimental treatment. (Shadish, W.

R., Cook, T. D., & Campbell, D. T, 2002, pp 13–14.). This verification was carried out using the **paired-samples t-test** for two equal related samples.

Table 2: Equivalence of the Sample in Physical and Skill Tests

Statistical analy		Experimental group		Calculated T-value	Degrees of Freedom (n - 1)	sig	Significance Level
	Variables	**mean**	**Standard deviation**				
Fr eestyle	**Strock coordination**	12	1.73	2.24	14	0.31	**Not Significant**
	Breathing technique	9.87	1.57	2.79		0.23	**Not Significant**
	Speed and performance	41.72	3.74	0.525		0.95	**Not Significant**
Breaststrocke	**Strock coordination**	12.13	1.56	2.80		0.27	**Not Significant**
	Breathing technique	13.2	1.48	3.14		0.22	**Not Significant**
	Speed and performance	48.96	4.93	0.537		0.951	**Not Significant**

It is evident from the table that all **sig** values range between **0.22 and 0.95**, which are greater than the significance level (**0.05**). This indicates the absence of statistically significant differences in all research tests, confirming that the experimental group is equivalent in the study variables.

18. Statistical Tools Used:

- Arithmetic mean
- Standard deviation
- Pearson correlation coefficient
- Reliability and validity coefficients
- Shapiro–Wilk normality test
- **T-test** for the significance of differences between means

19. Presentation, Analysis, and Discussion of Results

19.1. Presentation, Analysis, and Discussion of Pre- and Post-Tests for the Research Sample

A. Presentation and Analysis of *t*-Test Results for Differences Between Pre- and Post-Tests in the Freestyle Swimming Variables Under Study:

Table 3: presents the *t*-test results for the differences between the pre- and post-tests in the freestyle swimming variables under investigation.

Tests		Pre-tests		Post-tests		Calculated T-value	Degrees of Freedom (n - 1)	sig	Significance Level
		mean	**Standard deviation**	**mean**	**Standard deviation**				
freestyle	**Strock coordination**	11.33	1.80	12.27	1.67	3.50	14	0.0035	**Significant**
	Breathing technique	10.67	1.80	12.00	1.69	4.18		0.0009	**Significant**
	Speed and performance	41.72	3.74	39.58	4.04	7.12		0.000	**Significant**

It is evident from Table 3 which presents a comparison of pre- and post-test results for the study sample in freestyle swimming tests (**movement coordination – breathing – speed and performance**) — that there was a positive improvement in participants' performance after the implementation of the coach's training program.

The arithmetic mean in the pre-test was **11.33 – 10.67 – 41.72** with a standard deviation of **1.8 – 1.8 – 3.74**, whereas in the post-test, the mean increased to **12.27 – 12.00 – 39.58** with a standard deviation of **1.67 – 1.69 – 4.04**.

The results showed that the calculated *t* values were **3.5 – 4.18 – 7.12**, while the corresponding significance levels (Sig) were **0.0035 – 0.0009 – 0.000**, all of which are lower than the adopted significance level (**0.05**). This indicates the presence of statistically significant differences between the pre- and post-measurements in favor of the post-test, demonstrating that the applied training program had a clear positive impact on improving breaststroke performance.

B. Presentation and Analysis of *t*-Test Results for Differences Between Pre- and Post-Tests in the Breaststroke Variables Under Study

Table 4: presents the *t*-test results for differences between pre- and post-tests in the breaststroke variables under investigation.

Tests		Pre-tests		Post-tests		Calculated T-value	Degrees of Freedom (n - 1)	sig	Significance Level
		mean	Standard deviation	mean	Standard deviation				
Breaststrocke	Strock coordination	12.13	1.60	12.00	1.41	0.98	14	0.300	Significant
	Breathing technique	12.13	1.60	11.73	1.98	1.00		0.303	Significant
	Speed and performance	48.96	4.93	45.87	3.42	4.22		0.000	Significant

The data presented in **Table 4** compares the pre- and post-test results for the study sample in breaststroke swimming variables (coordination between movements, breathing, speed, and performance).

The results indicate a positive improvement in performance after the implementation of the training program, but only in the variables of speed and performance.

In the pre-test, the mean score for coordination between movements and breathing in breaststroke was 12.13–12.13 with a standard deviation of 1.60–1.60, while in the post-test, the mean increased to 12.00–11.73 with a standard deviation of 1.41–1.98. The results for breaststroke coordination between movements and breathing revealed calculated *t*-values of 0.98–1.00, with significance levels (*Sig*) of 0.300–0.3034, both exceeding the significance threshold of 0.05. This indicates no statistically significant differences between the pre- and post-test measurements, suggesting that the applied training program did not produce a clear positive effect on breaststroke coordination between movements and breathing.

In contrast, for the speed and performance variable in breaststroke, the pre-test mean was 48.96 with a standard deviation of 4.93, while the post-test mean decreased to 45.87 with a standard deviation of 3.42. The calculated *t*-value was 4.22, and the significance level (*Sig*) was 0.000, which is below the 0.05 threshold. This demonstrates statistically significant differences in favor of the post-test measurement, indicating that the training program had a clear positive effect on improving speed and performance in breaststroke swimming.

20. Discussion and Interpretation of the Results in Light of the Study Hypotheses

20.1. There are statistically significant differences between the pre- and post-test measurements in the motor coordination skill (freestyle swimming) in favor of the post-test.

Following the implementation of the training program, a *t*-test was conducted to detect statistical differences between the pre- and post-test results for motor coordination in freestyle swimming. The statistical analysis revealed significant differences at the level ($\alpha \leq 0.05$), with post-test performance averages higher than pre-test values. This clearly reflects a tangible improvement in the participants' skill levels.

This improvement can be attributed to the training program's contribution to enhancing participants' motor abilities through carefully planned training activities aimed at improving coordination between fine and gross muscular movements essential for efficient freestyle swimming. The program's use of progressive intensity, exercise variety, and repeated practical scenarios helped consolidate motor performance and systematically develop participants' skills. Therefore, it can be concluded that the training program achieved its intended objectives and demonstrated its effectiveness in developing motor coordination skills, consistent with previous studies confirming the role of targeted training programs in improving swimmers' skill performance.

20.2. There are statistically significant differences between the pre- and post-test measurements in the breathing skill (freestyle swimming) in favor of the post-test.

After applying the training program, a *t*-test was conducted to examine differences in breathing during freestyle swimming between the pre- and post-tests. The results revealed significant differences at the ($\alpha \leq 0.05$) level in favor of the post-test, indicating that the training program effectively improved participants' breathing skills.

This improvement can be explained by the inclusion of specialized exercises to regulate the timing of inhalation and exhalation during movement, ensuring synchronization between breathing and movement rhythm—a key factor in swimming efficiency. Repetition of drills and variation in positions and patterns also contributed to the development of lung capacity and breath control during performance, positively impacting swimmers' comfort and reducing muscular fatigue.

20.3. There are statistically significant differences between the pre- and post-test measurements in speed and performance (freestyle swimming) in favor of the post-test.

The *t*-test results indicated statistically significant differences in speed for freestyle swimming between the pre- and post-test measurements at the ($\alpha \leq 0.05$) level, in favor of the post-test. This

confirms that the training program increased the time efficiency for covering the designated distance. This improvement may be attributed to the program's focus on speed-oriented drills and short, high-intensity repetitions aimed at improving technique and strengthening muscles responsible for propulsion. Additionally, start, turn, and touch drills contributed to enhancing overall swimming speed, alongside psychological factors such as self-motivation and increased confidence in performance.

20.4. There are statistically significant differences between the pre- and post-test measurements in motor coordination (breaststroke swimming) in favor of the post-test.

The *t*-test results showed no statistically significant differences in motor coordination for breaststroke swimming between the pre- and post-tests at the ($\alpha \leq 0.05$) level, indicating that the training program did not produce a notable effect on this skill.

This could be due to several factors, such as insufficient program duration or training intensity to produce substantial improvement, or the homogeneity of the participants' initial performance levels, which reduced the potential magnitude of differences. Additionally, the measurement tools used may not have been sensitive enough to detect minor changes in coordination—a skill that generally requires prolonged, continuous training to achieve noticeable improvement.

20.5. There are statistically significant differences between the pre- and post-test measurements in breathing skill (breaststroke swimming) in favor of the post-test.

The *t*-test results revealed no statistically significant differences in breathing skill for breaststroke swimming between the pre- and post-tests at the ($\alpha \leq 0.05$) level, as the *p*-value did not reach the required significance threshold. This suggests that the training program did not have a clear impact on breathing efficiency among participants.

This may be due to the complexity of breathing in swimming, which requires precise coordination between head movement, inhalation and exhalation timing, and the rhythm of arm and leg movements. Such skills demand focused, individualized, and intensive training. Additionally, some participants may face psychological barriers, such as fear of full immersion or breath-holding underwater, which can hinder skill development even in the presence of a strong physical program. Furthermore, the training program may have been more focused on physical components (such as speed and strength) without allocating sufficient technical and instructional emphasis to breathing.

20.6. There are statistically significant differences between the pre- and post-test measurements in speed and performance (breaststroke swimming) in favor of the post-test.

The *t*-test results indicated statistically significant differences at the ($\alpha \leq 0.05$) level between pre- and post-test measurements for speed in breaststroke swimming, in favor of the post-test. This finding indicates that the training program contributed to improving participants' time efficiency, enabling them to cover the required distance in less time and with greater efficiency.

This improvement can be attributed to the program's targeted drills for enhancing propulsion, gliding, and movement timing—essential components in breaststroke swimming, which requires precise coordination between arm movements, leg kicks, and breathing. Short, high-intensity repeated drills, combined with improvements in start and turn techniques, enhanced participants' physical and explosive capabilities, which directly translated into improved overall speed.

21. Main Conclusions:

1- Effectiveness of the training program in freestyle swimming – Post-test results revealed a significant improvement in motor coordination, breathing, and speed/performance skills among participants in the freestyle swimming style. This confirms the quality and effectiveness of the implemented training program in developing both technical and motor performance.

2- Marked improvement in performance speed for both styles (freestyle and breaststroke) – The program contributed to enhancing time efficiency in performance, reflecting a genuine development of the physical and technical capacities related to speed in swimming.

3- Limited training effect on certain breaststroke skills – No statistically significant differences were observed in motor coordination and breathing in breaststroke swimming. This may be attributed to the short duration of the training period, the program's greater focus on specific skills over others, and the inherent nature of the studied skills, which typically require longer and more precise training for noticeable improvement.

4- Confirmation of the importance of scientifically designed programs – Results demonstrate that designing the program based on educational and scientific principles, incorporating gradual progression and variety in activities, clearly contributes to improving skill performance. This finding aligns with previous studies in the field of sports science.

- Recommendations:

1- Adopt comprehensive and integrated training programs aimed at developing all fundamental swimming skills, particularly fine skills such as breathing and motor coordination, while considering the specific requirements of each swimming style.

2- Extend the duration of programs targeting breaststroke development, with a greater emphasis on precise technical aspects, thereby allowing sufficient time to enhance the skills that did not show substantial improvement during the current experimental period.

3- Consider individual differences and psychological aspects of swimmers by providing psychological and educational support in parallel with physical training—particularly to address fear of immersion or difficulty in breath control, which are factors that can hinder training effectiveness.

4- Improve evaluation tools and methods by using more accurate and sensitive means of detecting performance improvements, such as video analysis or modern devices for measuring temporal and motor coordination.

5- Encourage further research on diverse participant groups in terms of age and skill level to assess the effectiveness of training programs in different contexts and to expand the scientific knowledge base in this field.

6- Integrate theoretical awareness sessions into training units, through short lessons explaining the fundamental principles of breathing and motor coordination. This can enhance participants' understanding, improve their capacity for self-learning, and foster self-correction during performance.

- References:

1) Ibn Manzur, 1990, Lisan al-Arab, Dar Sader, Beirut, Vol. 7
2) International Swimming
3) Federation, 2021, FINA Handbook.
4) Ibn Manzur, 1990, Lisan al-Arab, Dar Sader, Beirut, Vol. 10
5) Schmidt, R. A., & Lee, T. D., 2019, Motor Control and Learning, Human Kinetics.
6) Ibn Manzur, 1990, Lisan al-Arab, Dar Sader, Beirut, Vol. 6
7) Malina, R. M., Bouchard, C., & Bar-Or, O., 2004, Growth, Maturation, and Physical Activity, Human Kinetics.
8) Zayan, M, 1983, *Scientific Research: Its Methodology and Techniques*, Office of University Publications, 4th ed., Algeria.
9) Allawi, M. H., & Kamel, O. R, 1999, Scientific Research in Physical Education, Sports and Sport Psychology, Dar Al-Kitab Al-Hadith, Cairo.
10) El-Sayed, F. L, 2007, *Measurement and Testing in Physical Education*, Al-Kitab Center, Cairo.
11) Abdelhadi, N, 1999, *Educational Measurement and Evaluation*. Dar Wael for Printing and Publishing, 1st ed., Jordan.
12) Saber, F. A., & Khafaga, M. A, 2003, Fundamentals and Principles of Scientific Research. Al-Ishaa Technical Press and Library, Alexandria.
13) Shadish, W. R., Cook, T. D., & Campbell, D. T, 2002, Experimental and quasi-experimental designs for generalized causal inference, Boston: Houghton Mifflin.