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Research Paper

The Effect of Mini-Games in Developing Some Motor Abilities of Table Tennis Juniors

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ABSTRACT

This study aimed to investigate the impact of using mini-games in training programs to enhance certain motor abilities among junior table tennis players. Recognizing the increasing complexity and intensity of modern sports training, the researcher emphasized the importance of innovative and engaging methods—such as mini-games—for improving physical, psychological, and skill-related aspects of performance. The research employed an experimental method on a sample of 10 junior players from the Sabah Al-Kar'awi Youth Center in Najaf. The training program lasted 8 weeks, with three sessions per week, incorporating a variety of mini-game-based exercises designed to develop response speed, forehand, and backhand strokes. Pre- and post-tests were conducted using validated and reliable tools, including a Japanese-made response speed device (BATAK MICRO). Statistical analyses (Wilcoxon test, Pearson correlation, T-test) showed significant improvements in response speed and technical performance after the intervention.

The study concluded that mini-games:

- Significantly enhance response speed and motor coordination.
- Improve the execution of forehand and backhand strokes.
- Foster psychological well-being and motivation among young athletes.

Recommendations included integrating mini-games into regular training sessions, using video analysis for feedback, and conducting similar studies on other skills or sports.

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1. INTRODUCTION

What the world is witnessing in the field of sports training in various joint fields and rapid development has become the feature that characterizes this advanced era at the highest levels, achieving the best, fastest, and strongest, which came as a result of continuous and fruitful experiences in sports development and achievement, which achieves much creativity. Since it enters into the details of the athlete, it has become necessary to think accurately and soundly about the requirements of the game and its subtleties. For example, in correcting the motor path of the activity, anatomy, biomechanics, and kinesiology intervene to facilitate the mastery of movement and more effective and flexible performance and its mechanism. This saves us effort and time in sports training. Training in table tennis has its own specificity of compound and complex movements, in addition to its agility, speed of performance, quick reaction, and variety of strokes and directions. Therefore, a table tennis player must possess strong physical qualities, quick response, and control over body axis movements and movement mechanics ideally.

The diversity in training has realistic validity proven through various training units. Among these varied training units are mini-games and their effect on developing basic skills in table tennis, as they are part of the training units leading the player to higher levels and athletic achievement. They also have a psychological effect and instill a sense of fun and self-confidence in the athlete, which gives mastery in performance and muscular, motor, and cognitive harmony, developing physical fitness, mental, psychological, and skill abilities, love of the game, and sanctifying it in the player's psyche, especially for table tennis players, as it has a realistic impact on those who play table tennis in terms of development and achievement.

1.1 Research Problem

Table tennis is one of the sports games that requires high physical and skill efficiency. Its exercises and drills influence the development of players' motor, physical, and skill abilities, as well as response speed exercises that enhance the players' capabilities, especially among juniors. It has thus become necessary to find new educational means to serve the basic skills of the game. The use of solid training curricula has become a necessity and a fundamental pillar in sports training that contributes greatly to improving players' performance. The researcher, through his experience as a table tennis player and coach, noticed a weakness among junior table tennis players and that the training units are insufficient, and there is a lack of attention to psychological factors and other related factors such as the few friendly and competitive matches in leagues and local/international championships. Hence, the researcher sees that training curricula for junior players have become an urgent necessity, especially as this sport requires attention to motor, technical, tactical, and mental skills. There is also little use of assistive devices in improving the physical and skill level and enhancing players' response speed, which led the researcher to undertake this study on the effect of special training exercises on players in developing their motor, physical, and skill abilities and using a response speed device that helps improve response speed among table tennis juniors.

2. RESEARCH OBJECTIVES

1. To identify the effect of mini-games in developing some motor abilities of table tennis juniors.
2. To identify the differences between the experimental and control groups in developing some motor abilities of table tennis juniors.

Research Hypotheses

There is a significant correlation between mini-games and the development of some motor abilities of table tennis juniors and the performance level of the forehand and backhand strokes.

Research Fields

Human Field: Table tennis junior players in Najaf Al-Ashraf.
Time Field: From 26/10/2024.
Spatial Field: Youth Center of Najaf and Sabah Al-Kar'awi Juniors Club in Najaf.

3.1 RESEARCH METHODOLOGY

The nature of the studied problem is what determines the nature of the method used. Therefore, the researcher used the experimental method, which is considered "the closest and most accurate to solving many scientific problems, and the basic idea on which experimental research is based in its simplest form" and is linked to the law of the single variable. If there are two identical situations in all respects, and a certain element is added to one of them and not the other, then any change or difference appearing thereafter between the two situations is attributed to the existence of this added element. This fits the nature of the research problem, as experimentation is considered one of the most efficient means to reach reliable knowledge.

3.2 Research Population and Sample

The research population was determined to be the Sabah Al-Kar'awi Youth Center for table tennis in Najaf Al-Ashraf, and their number is (10) junior players. The comprehensive enumeration method was used to select the sample, which consists of (10) players.

3.2.1 Sample Homogeneity

In order to avoid the influences that may affect the research results due to individual differences among players and to reach a uniform and equal level of the sample, some skills that represent the sample's characteristics were determined to ensure their homogeneity in those skills that are considered influential in the experiment and must be controlled. Therefore, statistical treatment was conducted using the skewness coefficient, and Table (2) shows that, noting that the skewness coefficient in those variables ranged between (±1), and accordingly, the sample is considered normally distributed since "the closer the skewness coefficient values are to (±1), the more homogeneous the sample is considered."

Table 1: Table showing variables, mean values, standard deviation, median, and skewness coefficient for the research sample individuals

No.	Measurements and Tests	Unit	Mean	Median	Std. Deviation	Skewness Coefficient	Significance
1	Height	(cm)	173.5	174	11.45	-0.13	Non-significant
2	Weight	(kg)	65.62	67	4.35	-0.95	Non-significant
3	Age	(years)	26.42	26	10.49	-0.85	Non-significant
4	Arm Length	(cm)	74.6	75	10.45	-0.83	Non-significant
5	Training Age	(years)	6.5	6	10.22	-0.98	Non-significant

3.3 Devices and Tools Used in the Research

Devices and tools used in the research include:

- Sony camera, speed (300) frames per second, number (2)
- Chinese-made sports stopwatch, number (1)
- Medical scale
- Indoor hall for table tennis
- Table tennis rackets with legal specifications, number (10), type (Tibhar)
- Table tennis balls, number (20), type (Stiga)
- CDs, type (PRINCO), number (2)
- Metal measuring tape, length (3) m
- Cones, number (10)
- Assistant work team
- Arabic and foreign references
- Personal interviews

3.4 Research Procedures

3.4.1 Measurements and Tests Used in the Research:

The response speed variable was measured using a Japanese-made response speed device, type (BATAK MICRO0), which measures response speed. This device contains a number of lights that operate randomly and within specific times. The tester, after setting the time, turns off the lights as quickly as possible. The device includes a control panel showing the number of touches and time in minutes or seconds. The device is timed according to the working system after determining the time intended for conducting the tests, which was one minute. Then the tester is given one trial, and the trial is counted in the test in terms of number and time. Data is recorded for all players in the pre-tests, then the same test is repeated in the post-test, and the difference between the pre- and post-test is calculated. The figure below illustrates the testing method.

3.5 Pilot Study

Before proceeding with the main experiment, it is necessary to conduct a pilot study on a sample from the research population. The purpose is to test the research tools and instruments, as well as to extract the scientific bases of the tests. The researcher fulfilled all the requirements for conducting the pilot study, including submitting an official letter to the Sabah Al-Kar'awi Forum in Najaf Al-Ashraf. The purposes were:

1. To identify obstacles encountered during the main experiment.
2. To ensure the validity of the devices used.
3. To determine the time required to conduct each test and the total test time.
4. To distribute tasks among the assistant work team.
5. To ensure the smoothness of test execution.
6. To determine the scientific bases of the tests.

From this, the following was concluded:

- Organizing the tests during execution.
- Suitability of the tests for the research sample.
- Appropriateness of the test sequence for the workflow.
- Appropriateness of the devices used in the research.
- The tests are valid for use on the research sample individuals.

3.6 Scientific Bases of the Tests

In order to identify the scientific bases required for the tests (validity, reliability, and objectivity), and their applicability and suitability to the research sample individuals, the researcher aimed to adopt these bases in applying the tests despite their being standardized and referenced in multiple sources and studies.

3.6.1 Validity

Test validity means that "a valid test measures what it is designed to measure." To confirm the validity of the tests, the researcher used content validity and expert validity, which depends on experts' and specialists' opinions confirming that the tests measure the phenomenon they are intended to measure. The research tests were presented to experts and specialists to determine their validity in measuring response speed and basic skills in table tennis, and they confirmed their suitability for use on the research sample.

3.6.2 Test Reliability

Reliability means "the test gives the same or similar results if applied to the same individuals under the same conditions more than once." Reliability is measured using several statistical methods. The researcher calculated the reliability coefficient by reapplying the tests to a sample of (10) players in the pilot study on 10/10/2024, and after six days, i.e., on 16/10/2024, the second pilot test was conducted and the same players were retested as shown in the table displaying the scientific bases of the tests used in the research (reliability coefficient).

Table 2: Table showing the reliability coefficient values of the tests used in the research

No.	Tests	Correlation Coefficient
1	Response speed test	0.9
2	Forehand stroke test	0.82
3	Backhand stroke test	0.88

The table value of the correlation coefficient is (0.70) at degree of freedom (2) and a significance level (0.05)

3.6.3 Test Objectivity

Objectivity means "freedom from bias, prejudice, and not including personal factors in the judgments issued by the researcher." The researcher established the objectivity of the tests despite their being clear and easily understood by the sample individuals by presenting the tests to a group of experts and specialists. The tests that received the highest percentage were selected as they were agreed upon by more than one expert.

Furthermore, these tests are standardized and rely on measurement units that cannot be manipulated.

3.7 The Main Experiment

3.7.1 Pre-Tests

The pre-test for the research sample was conducted on 24/10/2024 at exactly three o'clock in the afternoon. All variables were controlled in terms of time, tools, and devices, as well as the assistant work team, to be applied similarly during the (post-test), i.e., after implementing the training curriculum. The tests were conducted in the hall of the Sabah Al-Kar'awi Forum in Najaf Al-Ashraf as it is suitable for conducting the tests. The researcher, with the help of the assistant work team, applied the tests according to a predetermined sequence. The response speed test was conducted, and the test results were recorded on the registration form. After that, the forehand and backhand skills were tested, and the performance was videotaped for later evaluation and analysis.

3.7.2 Application of the Training Curriculum:

After completing the application of the pre-tests, the researcher applied the training curriculum using special exercises, and the curriculum began to be applied on Wednesday, 26/10/2024, at a rate of three training units per week for (8) weeks. The last training unit was completed on Monday, 1/5/2023.

3.7.3 Post-Tests

After completing the implementation of the training program, the post-test was conducted for the research sample. The temporal and spatial conditions and means of the pre-test were taken into account, with the help of the assistant work team. The motor response speed was tested, followed by the forehand and backhand strokes, and the test was videotaped for the purpose of skill evaluation.

3.8 Statistical Means

The researcher used the statistical social package to calculate the following statistical means: (Arithmetic mean – standard deviation – median – skewness coefficient – Wilcoxon – interquartile range – simple Pearson correlation – T-test for correlated samples).

Presentation, Analysis, and Discussion of Results:

This chapter included presenting the results of the tests used in the research, analyzing them, and discussing them. They are (response speed test, forehand stroke, and backhand stroke) for the sample in both the pre- and post-tests. The researcher used the (Wilcoxon) test to determine the significance of the differences between the pre- and post-tests of the research sample. According to the model, the researcher obtained sufficient data about the results of the field experiment implemented on the experimental group. The results indicated significant differences between the pre- and post-tests and tangible progress among the sample individuals due to their application of the special exercises. Therefore, these results were presented in explanatory tables as follows:

4.1 Presentation of the Differences between the Pre- and Post-Tests for Response Speed

The researcher presented the results of the pre- and post-tests for the sample as shown in Table 3), and the results related to response speed were analyzed and discussed.

Table 3: Shows the response speed variable for the research sample and the model

No	Variables	Unit	Pre-test		Post-test		Wilcoxon Value	Significance	Model
			Median	IQR	Median	IQR			
1	Response Speed	Second	100	0.75	110	1	2.78	**Signified**	113.47

Wilcoxon table value at sample size (6) and significance level (0.05) is (12)

From Table 3, it is clear that the difference was significant between the pre- and post-test in the response speed test and in favor of the post-test. Figure 1 illustrates that. The median in the pre-test was 100, with an interquartile range of 0.75, while the median in the post-test was 110, with an interquartile range of 1. The calculated Wilcoxon value was 2.78, which indicates a significant difference in favor of the post-test.

Discussion of the Response Speed Variable Results:

The researcher attributes the reason for the sample's development to the use of exercises with assistive means, which included mini-games and the ball launcher device, and multiple balls. Repetition of exercises using the above means during the first training units helped improve response speed in table tennis. As "learning similar and identical movements through repetition results in a positive transfer to the greatest degree in learning them." Moreover, most of the exercise time was focused on players' skill performance through the use of exercises on both sides of the table with multiple balls and repeating different types of strokes. Also, the players' consistency and regularity in training led to an indirect development in response speed. As mentioned by (Qasim Hassan Hussein & Fathi Al-Muhshash, 1999): "For young athletes to reach the best level, they must begin by implementing a comprehensive training plan that avoids focusing on one element of physical fitness. Table tennis training focuses on developing skills fundamentally, and through skills, the player develops physically without direct physical training."

4.2 Presentation and Discussion of the Differences between Pre- and Post-Tests in the Level of Technical Performance of Forehand and Backhand Strokes

To determine the results of the pre- and post-tests of the sample, the researcher used the (Wilcoxon) test for small samples to identify the significance of differences between the two tests, as shown in Table (4).

Table 4: Shows results of the forehand and backhand strokes for the research sample and the model

No	Variables	Unit	Pre-test		Post-test		Wilcoxon Value	Significance	Model
			Median	IQR	Median	IQR			
1	Forehand Stroke	Score	3	0.75	7.2	1.25	5.7	**Signified**	113.47
2	Backhand Stroke	Score	3.1	1	7	1.25	4.28	**Signified**	

Wilcoxon table value at sample size (6) and significance level (0.05) is (12)

From Table (4), it is clear that all differences were significant between the pre- and post-tests in the performance level test of the sample compared to the model. Figure (2) illustrates the arithmetic means of the sample. The median of the forehand stroke in the pre-test was (3) with an IQR of (0.75), while the post-test median was (7.2) with an IQR of (1.25). The calculated Wilcoxon value was (5.7), indicating a significant difference between the pre- and post-tests in favor of the post-test.

Discussion of the Forehand and Backhand Strokes Test Results for the Sample: The results that appeared in the sample's tests show that there was significant development in the performance of both the forehand and backhand strokes. The researcher attributes this to the diverse exercises and different and basic training means and mini-games in table tennis rather than sticking to stereotypical exercises and repetition of basic skills. Continuation of the coach's exercises in the training units showed results indicating a significant difference between pre- and post-tests for these basic skills in favor of the post-test. The sample's development in performing the forehand and backhand strokes was due to the exercises included in the training units during the experiment period using special exercises, basic skill development drills in table tennis, varying speeds, mini-games, and the ball launcher device and multi-ball exercises. "As performance must be executed at high speed to surprise the opponent and not give them a chance to respond correctly, and to achieve this, the motor path, temporal and spatial field must be controlled to reach the automation stage in technical performance." (1) The researcher attributes the significant differences in the sample's forehand and backhand strokes to the repeated exercises applied by the group, which rely on gradual training that led to enhanced learning. This agrees with what Schmidt 1982) pointed out: "To achieve learning, there must be attempts to practice the exercise, and the most important variable in motor learning is motor practice and the exercise itself." (2)

5. CONCLUSIONS

Based on the results reached by the researcher, the following conclusions were made:

1. There is a significant correlation between the forehand and backhand strokes.
2. There is a significant correlation between the backhand stroke and response speed.

6. RECOMMENDATIONS

1. Emphasizing the skill aspects of forehand and backhand performance as a very important factor in performing both strokes.
2. Coaches should focus on filming players during training to study the variables, address weak points, and enhance their strengths as they affect performance.
3. Conduct similar studies on other basic skills and different variables.
4. Conduct studies on other activities to know the relationship between skill performance and improvement in response speed.
5. Focus on mini-games due to their effective role in developing physical fitness and spreading joy, fun, and happiness among table tennis juniors.

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