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The Effect of Special Exercises Using a Proposed Electronic Device on Developing Some Skill and Motor Abilities among Young Boxing Players Aged 16–17 Years at Al-Rafidain Club

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Abstract: *This study aims to design a proposed electronic skill–motor device and develop specialized exercises to enhance selected motor and skill abilities among young boxing players aged 16–17 years at Al-Rafidain Club. The experimental method was applied using a two-group design (experimental and control) with pre- and post-tests. The sample consisted of 12 boxers within the weight categories of 60 kg, 64 kg, and 69 kg, evenly divided between the two groups. The electronic device was designed with the assistance of a computer engineer and underwent two preliminary trials before being integrated into an eight-week specialized training program. The results revealed significant improvements in the reaction speed of straight and side punches, as well as dynamic balance, particularly in the experimental group compared to the control group. The findings confirm that utilizing the proposed electronic device provides more effective development of motor skills and punching performance than traditional training methods. The researcher recommends incorporating this device into regular training sessions and conducting further studies in other sports disciplines to evaluate its broader applicability.*

Keywords: *Special exercises; electronic device; reaction speed; dynamic balance; punching skills; young boxers.*

Introduction

Training is the basic activity through which athletes' potential is developed and uplifted into higher performance levels. Training, therefore, can be defined as a planned activity intended to bring about measurable changes in the level of performers, developing their ability to undertake specific events, fine-tuning their skills, adding practical experience, and improving technical execution and behavior toward better performance.

The huge progress achieved in sports sciences was the result of a qualitative leap in different fields of sports, through the integration between modern technology and training tools that support it.

Boxing is characterized by powerful and speedy movements and skills because sudden quick changes take place within fighting postures which require a fast response from the boxer's body. These are responses or abilities to execute very accurate punches corresponding to various situations of fight punching remains most critical skill deciding

about ability scores points wins matches. As one of the competitive games it kept pace with continuous modernization in harmony with what has been imposed by specialized committees from rules and regulations to ensure fair competition and safety for the players.

The significance of this study is to design an electronic device where skill and motion can be integrated through certain exercises performed using the device to enhance punching skills, improve reaction speed, and develop dynamic balance. All these elements collectively enable the boxer to overcome the opponent and achieve victory.

Research Problem

While watching several boxing matches and interviewing many coaches, the researcher found obvious weak speed in the reaction of boxers during straight and side punches and Instability while blocking opponent punches. This imbalance mostly makes the players fall in the ring and miss counterpunching opportunities.

This is due mostly to the fact that modern technologies and electronic devices are used in training sessions. Thus, the researcher thought of creating a new electronic device that would merge between skill and speediness of movement. Special exercises were set using this device to imitate actual fight situations and enhance motor reaction time for punches- dynamic balance as well as coordination; with an ultimate aim at raising technical level together with performance quality among players up-to elites' standard.

Research Objectives

1. To design a proposed electronic skill-motor device.
2. To prepare special exercises using the proposed device to develop selected motor and skill abilities in the experimental sample.
3. To identify the effect of these special exercises performed using the proposed device on the research variables.

Research Hypotheses

1. There are statistically significant differences between the experimental and control groups in the pre- and post-tests, in favor of the post-tests, in developing some motor and skill abilities.
2. There are statistically significant differences between the experimental and control groups in the post-tests, in favor of the experimental group.

Research Fields

1. Human Field: Young boxing players at Al-Rafidain Club within the weight categories (60–64–69 kg).
2. Time Field: From December 3, 2024, to April 9, 2025.
3. Spatial Field: The boxing hall at Al-Rafidain Sports Club.

Methodology

Research Method

The researcher used the experimental method employing a two-group design (experimental and control) with pre- and post-tests. This approach was chosen because it

aligns with the nature of the research problem and allows accurate assessment of the device's effect on the selected motor and skill variables.

Research Population and Sample

The research population consisted of 21 young boxing players from Al-Rafidain Sports Club across all weight categories.

To maintain consistency, only players with similar weights (60 kg, 64 kg, and 69 kg) were selected because boxing performance is weight-dependent. The final research sample included 12 boxers, equally divided into two groups:

a. Experimental group: 6 players
b. Control group: 6 players

Sample Homogeneity and Group Equivalence

To verify that the two groups were similar and not affected by extraneous variables, statistical methods were used to establish homogeneity and equivalence in the subsequent variables:

a. Height
b. Weight
c. Age
d. Right straight punch
e. Left straight punch
f. Dynamic balance

Table 1: Homogeneity of the Research Sample

Variable	Unit	Mean	SD	Median	Skewness	Coefficient of Variation
Height	cm	173.00	2.59	173.00	0.133	1.498%
Weight	kg	64.42	3.80	64.00	0.114	5.899%
Age	year	16.58	0.51	16.00	0.388	3.099%
Right straight punch test	point	3.78	0.21	3.70	0.615	5.631%
Side punch test	point	6.60	0.10	6.50	0.703	1.590%
Dynamic balance	count	3.75	0.87	3.50	0.441	23.093%

The skewness value is acceptable when within ±1.

All coefficients of variation were below 30%, confirming the sample's high internal consistency.

Group Equivalence

To eliminate any influence of external variables on the experimental outcomes, equivalence was tested statistically between the two groups for the same variables.

Group Equivalence in Research Variables

Variable	Experimental Group (Mean ± SD)	Control Group (Mean ± SD)	t-value	Significance Level	Difference
Height	172.67 ± 3.39	173.33 ± 1.75	0.428	0.677	Random
Weight	64.17 ± 3.49	64.67 ± 4.41	0.218	0.832	Random
Age	16.50 ± 0.55	16.67 ± 0.52	0.542	0.599	Random
Right straight punch	3.75 ± 0.68	3.81 ± 0.60	0.491	0.625	Random
Side punch	6.55 ± 0.69	6.67 ± 0.49	0.352	0.831	Random
Dynamic balance	3.83 ± 0.75	3.67 ± 1.03	0.319	0.756	Random

t-table value (df=10, p≤0.05) = 1.734

No significant differences appeared between the groups, confirming that they were equivalent in all measured variables before the experiment.

Tools, Instruments, and Devices Used

a. Arabic and foreign scientific sources
b. Observation and experimental methods
c. Personal interviews
d. Measurement and testing tools
e. Data collection and recording forms
f. Medical scale (Chinese-made) for weight and height
g. Two stopwatches
h. Supporting work team
i. Canon camera
j. Boxing gloves
k. Colored laser light

Device Design

The researcher designed a proposed electronic device to develop reaction speed and dynamic balance. After consulting the supervisor and specialists in sports training and boxing coaching, a device was developed that integrates electronic signaling and motor performance to train players on reaction timing for both right and left punches while maintaining balance.

The device emits random, rapid light signals that require instant motor response and balance. It is mounted on a rubber trampoline, making it difficult for players to maintain stability.

The system simulates competitive boxing conditions, where players react to flashing lights by delivering various punches (straight and side) according to the light's position.

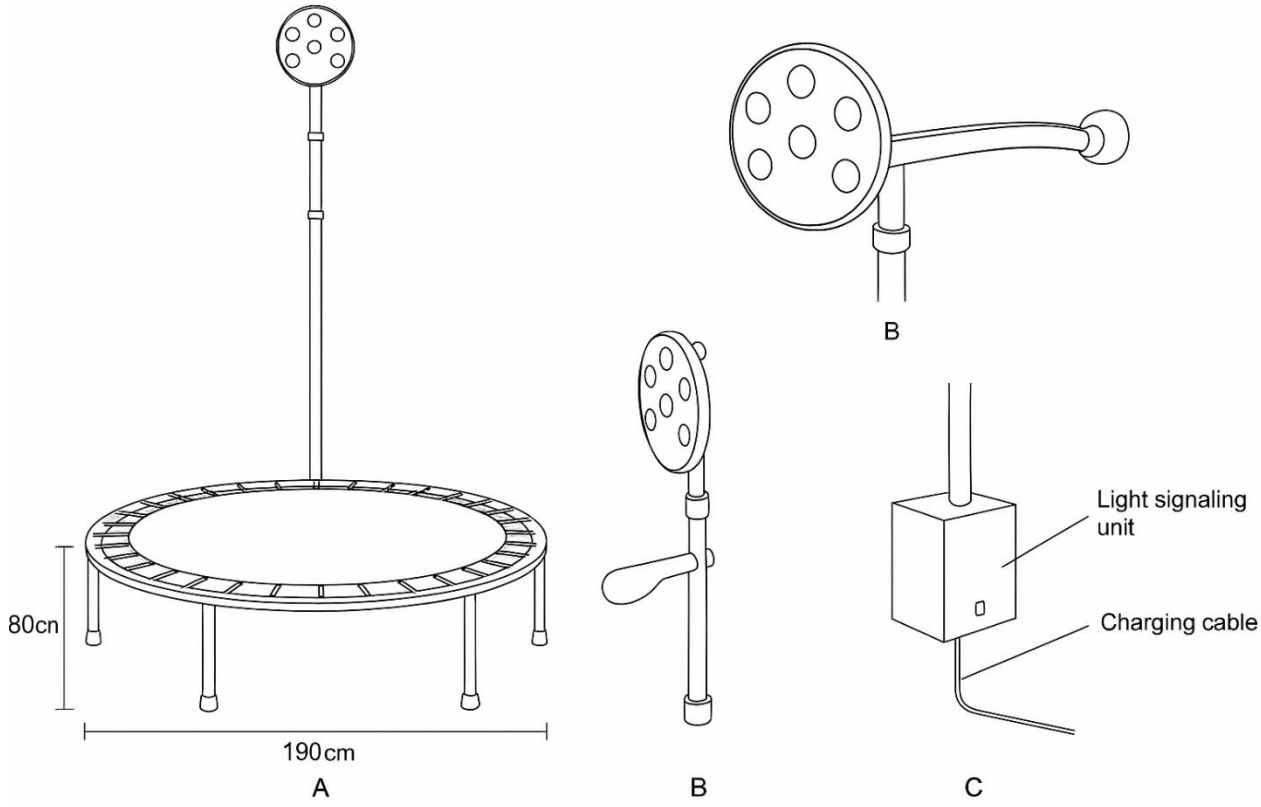
The device's movable arm rotates upward at varying speeds to engage the athlete defensively. Each operation lasts 15 seconds, and the cycle repeats after short intervals.

Components of the Proposed Device

a. Circular trampoline (dia: 190 cm, 7 leg support, and elastic cords)
b. Adjustable metal stand (ht: 180 cm)
c. Circular holder with back supports and locking mechanisms for the light indicators
d. Light signaling unit with sensors and control circuits
e. External charging cable

The maximum weight this device can hold cumulatively is 105 kg. Six light sensors are covered with rubber for safety. It gives audible feedback on correct or wrong punches accompanied by motivating sound.

When fully charged, it can last for about three hours during training.



(**Figures A, B**, and C illustrate the main parts of the proposed device.)

Determining Research Variables

The research variables were determined by a review of prior studies, references, and expert views, in concordance with the academic supervisor. The final chosen variables were:

- Reaction speed for straight and side punches.
- Dynamic balance.
- Motor coordination.

Determining the Research Tests

Tests were selected according to recognized scientific criteria and guidance from experts in sports training and motor performance.

A. Boxing Reaction Speed Test (Modified Form)

- Goal: To find out how quickly the boxer can respond.
- Tools: A boxing bag, light gloves, and two high-speed cameras that can take 300 frames per second.

B. Balance Test

- Name: The Octagonal Balance Test.
- Goal: To test how well you can balance while moving.
- Equipment: An octagonal wooden structure with sides that are 60 cm long, 20 cm high, and 8 cm wide. A line is drawn across one side to show where the beginning and finish are.

Exploratory Experiments

First Exploratory Trial: A trial sample was obtained from outside the main group on Friday, December 13, 2024, at 3:00 PM at Al-Rafidain Sports Club.

a. Goal: To make sure that the specified electronic equipment works well and is suitable for the participants' ability levels.
b. Results: The device worked well, but some improvements were made to make it simpler to operate.

Second Exploratory Trial: Conducted on Saturday, December 14, 2024, at 3:00 PM in the same venue.

- Purpose:
  1. Find problems or things that make the exams harder.
  2. Figure out how long the experiment will take.
  3. Make sure the assistance team is ready and that the participants know what to do.

Scientific Foundations

2.12.1 Test Validity: The self-validity method was applied, calculated as the square root of the reliability coefficient.

2.12.2 Test Reliability: The test–retest method was used on a group of five boxers.

- First test: Monday, December 16, 2024.
- Retest: Monday, December 23, 2024 (after 7 days).

The Pearson correlation coefficient ($r = 0.878$) at $p \leq 0.05$ confirmed strong reliability under identical conditions.

2.12.3 Test Objectivity of the Designed Device

The tests were reviewed by a panel of expert referees to ensure objectivity.

Table 3: Reliability, Validity, and Objectivity Coefficients

Variable	Reliability	Validity	Objectivity
Straight punch	0.998	0.999	0.967
Side punch	0.996	0.998	0.983
Dynamic balance	0.984	0.992	0.989

Pre-Tests

The pre-tests were done over two days in a row after making sure the gadget was ready and that the testing settings were the same for everyone.

a. Skill Tests: Straight and side punches will take place on Friday, December 27, 2024, at 3:00 PM.
b. Motor Tests: Dynamic balancing, which took place on Saturday, December 28, 2024, at 3:00 PM.

Training Program Using the Proposed Device

a. Training started on Sunday, December 29, 2024, and went on for eight weeks. Three times a week, on Sunday, Tuesday, and Thursday.
b. Total number of training units: 24 sessions.
c. During the special preparation period, exercises were used.
d. The last level of training was at 100% intensity.
e. The program terminated on Thursday, February 20, 2025.

Post-Tests

On Friday, February 21, 2025, post-tests were given under the identical settings as the pre-tests.

Statistical Methods

Data were processed using SPSS software (version 22). The following statistical tools were used:

a. The mean and the standard deviation.
b. The coefficient of variation.
c. Skewness.
d. t-test for samples that are linked and ones that are not.
e. The Pearson correlation coefficient.

Result and Discussion

Presentation of Pre- and Post-Test Results for Research Variables (Experimental and Control Groups)

A. Results for the Experimental Group

Table 4: Differences Between Pre- and Post-Tests in Research Variables (Experimental Group)

Variable	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	t-value	Sig.	Difference
Straight punch	3.75 ± 0.68	5.50 ± 0.42	3.09	0.006	Significant
Side punch	6.52 ± 0.69	8.57 ± 0.55	2.91	0.012	Significant
Dynamic balance	3.83 ± 0.75	2.67 ± 0.52	7.00	0.001	Significant

critical t-value (df = 5, p ≤ 0.05) = 2.015

The estimated t-values were higher than the critical value for all variables, which means that the improvements in post-tests were statistically significant. The improvements in punching accuracy and balance are due to the specific workouts done with the electronic gadget, which supports the initial study hypothesis.

Results for the Control Group

Table 5: Differences Between Pre- and Post-Tests in Research Variables (Control Group)

Variable	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	t-value	Sig.	Difference
Straight punch	3.81 ± 0.60	5.22 ± 0.71	3.89	0.023	Significant
Side punch	6.67 ± 0.49	8.10 ± 0.60	2.97	0.031	Significant
Dynamic balance	3.67 ± 1.03	3.17 ± 0.76	1.41	0.203	Random

While the control group exhibited enhancements in their skill variables, dynamic balance shown no significant alteration, suggesting that traditional training did not adequately develop this capacity.

Comparison of Post-Test Results Between Experimental and Control Groups

Table 6: Differences Between Groups in Post-Test Results

Variable	Experimental Group (Mean ± SD)	Control Group (Mean ± SD)	t-value	Sig.	Difference
Straight punch	5.50 ± 0.42	5.22 ± 0.71	1.41	0.459	Random
Side punch	8.57 ± 0.55	8.10 ± 0.60	1.50	0.307	Random
Dynamic balance	2.67 ± 0.52	3.17 ± 0.76	1.34	0.209	Random

Critical t-value (df = 10, $p \leq 0.05$) = 1.812

The experimental group fared better on certain numbers, but the changes were not statistically significant for all factors. Still, the general trend showed that players who trained with the suggested equipment did better.

Discussion of Results

Results illustrated that a development took place in the two groups between the pre- and post-tests, confirming that structured and scientific training leads to improving performance. Training is more effective in developing it when accompanied by using the proposed electronic device, hence emphasizing the result which Abu Al-Ala (1987) stated: structured and scientifically planned training enhances efficiency at both levels-neuromuscular and physical coordination.

Technology based training tools deliver stimuli to the players, which are very close to real combat situations thereby making the players ready with precise reactions. Such kind of training introduces an environment between technology and humans where immediate cognitive and motor responses are pressed due to variable light signals of the device hence enhancing athletes' decision making under pressure.

The results affirm that the use of new, interactive training tools involve and improve boxing-specific skills by reaction speed, dynamic balance in addition to overall technical performance. As Mohammed Abdullah et al. (2010) noticed, an optimum level of sports preparation can be achieved through a systematic increase in training load and exercise selection most appropriate to the biomechanical needs of an athlete.

Mowafaq Asaad Mahmoud (2008) has also said that quick reaction helps an athlete control sudden competitive situations which is experimentally proved in this study.

Conclusion

1. The usage of customized workouts using the suggested electronic equipment made young boxers at Al-Rafidain Club much faster at reacting to straight and side blows.
2. The suggested gadget also helped dynamic balance improve a lot.

Recommendations

1. Use the electronic training equipment in regular boxing classes to help athletes enhance their skills and motor skills.
2. Conduct analogous research in several sports disciplines to assess the device's efficacy in improving motor and skill-related characteristics.

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