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# Efficiency and modelling of the technical training of U12 tennis players by validating the information obtained with the Ansys software

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**Abstract**. For the basic research experiment, we proposed to use this method with existing additions, but which we did not access in the preliminary study, namely with the use of ANSYS software that allows the direct modeling of the U12 players movement translation into kinematic data. The main methods used to fulfill the tasks proposed for the research are the following: studying specialized literature, pedagogical observation, test method, the statistical-mathematical method and the graphic and tabular method (through the SPSS calculation program). We applied a specific formula to the research subjects to calculate the period of movement in seconds for each subject in part of each hit. These calculations allowed us to analyze and quantify the movements of each player during the shot, thus providing us with concrete and objective data to evaluate the effectiveness of the proposed algorithmic systems. In conclusion, the implementation of experimental programming in tennis training can be beneficial for improving the performance of players. Special care is needed in the analysis and continuous adjustment of training methods to ensure the continuous progress of athletes.
**Keywords (3–5):** Ansys software, SPSS, U12 players

## 1. Introduction

ANSYS offers a wide range of functionality, including structural, dynamic, thermal, fluid dynamic and electromagnetic analysis. Its interface allows easy integration of different modules, providing a complete simulation environment [1].

The purpose of the research is to deepen the application of the ANSYS software associated with the prioritization of objectives in modeling the technique of hitting the ball on the right shot in the game of tennis for players aged between 10-12 years, both based on the results obtained in study 1, and through capitalizing on the information obtained with its help.

Hypothesis 1

Design and scaling of algorithmic systems in the intervention process for improving the forehand and forehand volley in the attacking phase of the tennis game at the level of subjects, using data provided by ANSYS software for ages 10-12.

Hypothesis 2

The results obtained as a result of the technical training evaluation process confirm the effectiveness of the algorithmic system scheduling in the training lessons under a technical qualitative aspect, at the level of U12 tennis players.

The relevant literature has shown that it is possible to achieve the desired movement patterns and ensure the development of skills in sports by ignoring the influence of developments in motor learning based on changes in movement coordination on results or subjective evaluations of movement patterns [2]. However, it is necessary for coaches to easily perform accurate technical evaluations to create the desired movement patterns.

The methods used in this research were structural and modal analysis, with the use of ANSYS software for modeling and simulation. Findings are reported and based on kinematic data of U12 tennis players and compared to theoretical values.

## 2. Materials and methods

Pedagogical observation was used in order to debate the current issue, accompanying individual training lessons. At the same time, she contributed to the observance of the principles of individualized training and the ways of applying methods and means to improve technical-tactical training.

Graphical and tabular method were used to highlight the results obtained. The graphic representation will be made by means of the SPSS calculation program.

## 3. Basic research content

In order to improve the content of the training hours, the achievement of the objectives and the requirements of this type of activity at a high level of all the compartments of learning, improving and practicing the game of tennis, a careful analysis and a concern for the efficiency of the methodical training path in terms of regarding game content, technical procedures, tactical actions and optimization physical condition. In this sense, an experiment was carried out based on the organization of training using an experimental program. In this study, we followed a number of important aspects, namely: Carrying out initial and final testing – algorithmic systems for right/left attack phase improvement and right/left attack phase volley improvement.

A. Algorithmic system for perfecting the right/left shot in the attack phase:

LD1 – Execution of the right/left attack shot (figure 1), but after a sequence of 4.6 right shots from the service line area of the court (4-8x; p-30s).

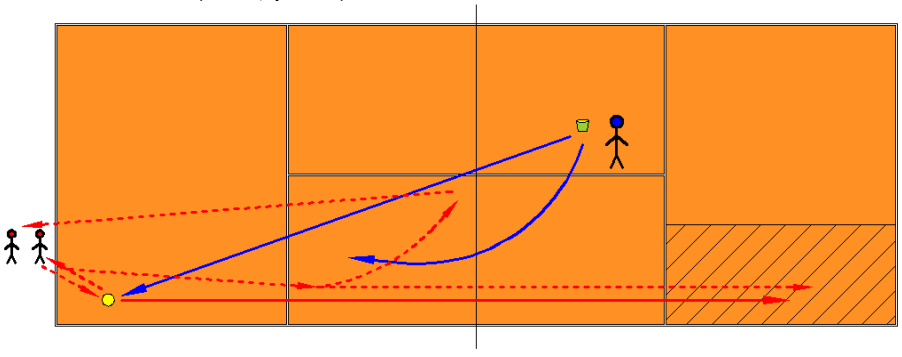

**Figure 1**

B. Algorithmic system for perfecting the right/left volley in the attack phase:

Vol1 – Practicing the right volley along the line to the ball launched by the teacher from the service area (figure 2), with the sending into the cross-hatched area (8-10x; p-30s). The seme exercise can be

performed with the ball being thrown by the teacher from behind the field, and the ball will be send into the cross.

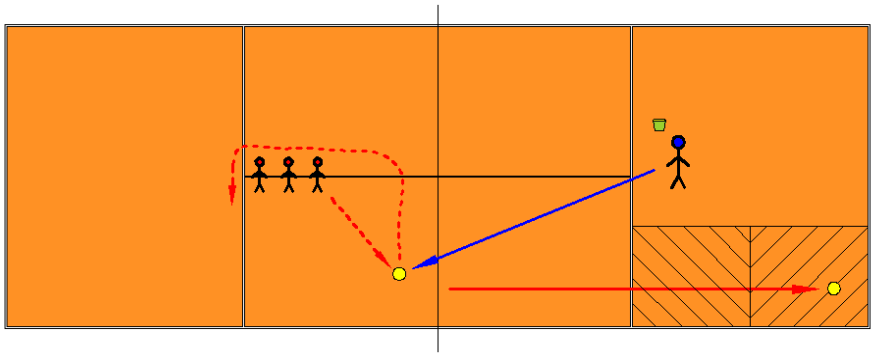

**Figure 2**

## 4. Results

In order to argue and prove Hypothesis 1 regarding the development and implementation of algorithmic systems for perfecting the forehand shot and the right volley shot in the attack phase of the tennis game at the level of subjects aged between 10-12 years, we applied the formula to the research subjects fx = 0.358sin (2pi*n strokes/60*x).

**Table 1. Initial testing – male**

| No. Crt. | Name and surname | Movement period in seconds $LD_1$ | Movement period in seconds $LD_2$ | Movement period in seconds $LD_3$ | Movement period in seconds $LD_4$ | Movement period in seconds $LD_5$ | Movement period in seconds $LD_6$ | Movement period in seconds $LD_7$ | Movement period in seconds $LD_8$ |
|---|---|---|---|---|---|---|---|---|---|
| 1. | A.S. | 1.58 | 7.50 | 5.00 | 3.33 | 4.29 | 2.73 | 5.00 | 7.50 |
| 2. | M.D. | 1.62 | 6.67 | 4.62 | 3.00 | 3.75 | 2.86 | 4.62 | 6.67 |
| 3. | B.A. | 2.22 | 15.00 | 7.50 | 4.62 | 6.67 | 4.00 | 8.57 | 15.00 |
| 4. | C.T. | 2.14 | 12.00 | 8.57 | 4.62 | 7.50 | 4.29 | 7.50 | 15.00 |
| 5. | D.M. | 2.40 | 12.00 | 7.50 | 4.00 | 7.50 | 4.29 | 7.50 | 12.00 |
| 6. | I.R. | 2.14 | 10.00 | 6.67 | 4.29 | 6.67 | 4.00 | 6.67 | 10.00 |
| 7. | M.M. | 2.31 | 15.00 | 6.67 | 5.45 | 8.57 | 3.75 | 10.00 | 12.00 |
| 8. | R.A. | 2.31 | 12.00 | 8.57 | 5.00 | 7.50 | 3.33 | 8.57 | 15.00 |
| 9. | T.S. | 2.50 | 15.00 | 10.00 | 4.62 | 8.57 | 3.53 | 8.57 | 12.00 |

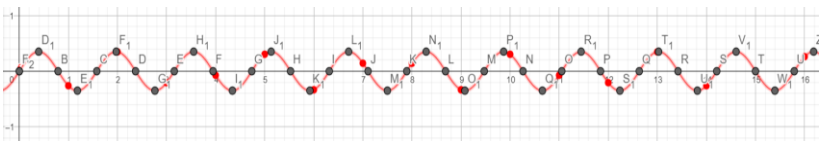

**Figure 3. Chart A.S. initial LD1 period 1.58 sec**

**Table 2. Final testing – male**

| No. Crt. | Name and surname | Movement period in seconds $LD_1$ | Movement period in seconds $LD_2$ | Movement period in seconds $LD_3$ | Movement period in seconds $LD_4$ | Movement period in seconds $LD_5$ | Movement period in seconds $LD_6$ | Movement period in seconds $LD_7$ | Movement period in seconds $LD_8$ |
|---|---|---|---|---|---|---|---|---|---|
| 1. | A.S. | 1.36 | 4.62 | 3.33 | 2.31 | 2.86 | 2.14 | 3.33 | 4.29 |
| 2. | M.D. | 1.40 | 4.00 | 3.16 | 2.22 | 2.61 | 2.07 | 3.00 | 4.00 |
| 3. | B.A. | 2.07 | 12.00 | 5.45 | 3.75 | 5.45 | 3.75 | 7.50 | 12.00 |
| 4. | C.T. | 1.94 | 8.57 | 6.00 | 3.53 | 6.00 | 4.00 | 6.00 | 10.00 |
| 5. | D.M. | 2.07 | 10.00 | 6.00 | 3.33 | 5.45 | 3.75 | 5.45 | 7.50 |
| 6. | I.R. | 2.00 | 7.50 | 4.62 | 3.33 | 6.00 | 3.53 | 5.00 | 8.57 |
| 7. | M.M. | 2.14 | 8.57 | 5.45 | 4.00 | 5.45 | 3.16 | 7.50 | 7.50 |
| 8. | R.A. | 2.07 | 10.00 | 6.67 | 4.29 | 6.67 | 3.00 | 6.00 | 10.00 |
| 9. | T.S. | 2.40 | 10.00 | 6.67 | 3.53 | 6.67 | 3.16 | 6.67 | 7.50 |

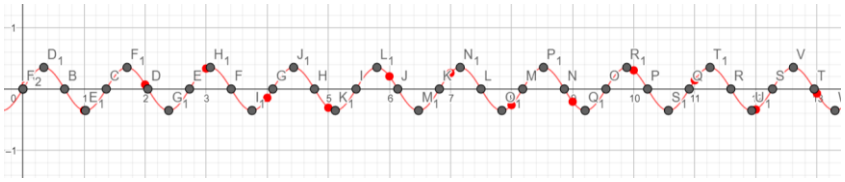

**Figure 4. Chart A.S. final LD1 period 1.36 sec**

The results of the comparative analysis between Figure 3 and Figure 4 indicate a reduction in the duration of a stroke administered by subject A.S. from 1.58 seconds to 1.36 seconds. This decrease of 0.22 seconds per shot represents a 14% decrease in the time required for each shot performed by subjects A.S.

**Table 3. Initial testing – female**

| No. Crt. | Name and surname | Movement period in seconds $Vol_1$ | Movement period in seconds $Vol_2$ | Movement period in seconds $Vol_3$ | Movement period in seconds $Vol_4$ | Movement period in seconds $Vol_5$ | Movement period in seconds $Vol_6$ |
|---|---|---|---|---|---|---|---|
| 1. | G.E. | 2.31 | 2.31 | 2.14 | 2.22 | 1.67 | 1.67 |
| 2. | M.C. | 2.22 | 2.31 | 2.14 | 2.14 | 1.67 | 1.62 |
| 3. | A.P. | 3.33 | 3.75 | 3.75 | 3.53 | 2.73 | 2.86 |
| 4. | B.M. | 3.33 | 3.53 | 3.33 | 3.53 | 2.61 | 2.40 |
| 5. | C.A. | 4.00 | 3.16 | 3.33 | 3.16 | 2.50 | 2.40 |
| 6. | F.M. | 4.29 | 3.00 | 2.86 | 2.73 | 2.86 | 2.31 |
| 7. | S.A. | 3.53 | 3.16 | 3.00 | 2.86 | 2.40 | 2.61 |

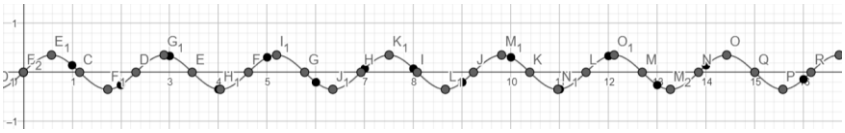

**Figure 5. Chart G.E. initial Vol1 period 2.31 sec**

**Table 4. Final testing – female**

| No. Crt. | Name and surname | Movement period in seconds $Vol_1$ | Movement period in seconds $Vol_2$ | Movement period in seconds $Vol_3$ | Movement period in seconds $Vol_4$ | Movement period in seconds $Vol_5$ | Movement period in seconds $Vol_6$ |
|---|---|---|---|---|---|---|---|
| 1. | G.E. | 1.94 | 1.88 | 1.76 | 1.82 | 1.46 | 1.43 |
| 2. | M.C. | 1.88 | 1.88 | 1.71 | 1.76 | 1.40 | 1.36 |
| 3. | A.P. | 2.73 | 3.00 | 2.86 | 3.53 | 2.22 | 2.31 |
| 4. | B.M. | 2.61 | 2.73 | 2.61 | 3.53 | 2.31 | 2.07 |
| 5. | C.A. | 3.16 | 2.50 | 2.61 | 3.16 | 2.07 | 2.07 |
| 6. | F.M. | 3.16 | 2.61 | 2.40 | 2.73 | 2.14 | 1.94 |
| 7. | S.A. | 2.86 | 2.73 | 2.31 | 2.86 | 2.22 | 2.07 |

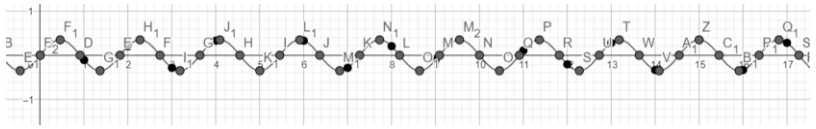

**Figure 6. Chart G.E. final Vol1 period 1.94 sec**

Comparative analysis of the results between Figure 5 and Figure 6 shows that the duration of a stroke administered by subject G.E. dropped from 2.31 seconds to 1.94 seconds. This reduction of 0.37 seconds per shot represents a 16% reduction in the time required for the volley shot by G.E.

In order to demonstrate the veracity of Hypothesis 2 in the experimental research, I used the IBM SPSS Statistics 20 statistical program to process the recorded results. The data related to the algorithmic systems presented above were analyzed statistically. Based on the final results presented for the control and experimental samples, both male and female, we can state that Hypothesis 2 was demonstrated for all 2 implemented algorithmic systems.

## 5. Conclusions

In conclusion, our study succeeded in achieving the proposed demonstrating the effectiveness of our research method. We have identified certain patterns that may be useful for future studies in our area of interest.

The results showed that the players in the experimental group achieved significant improvements in terms of playing techniques, tactical strategies and physical condition.

Based on the results of the initial tests, I identified each player`s strengths and weaknesses and was able to develop customized strategies to improve their performance.

During the final tests, players were put through simulated game situations where we applied techniques and strategies to execute forehand and lefthand shots effectively.

Therefore, the implementation of experimental programming in tennis training can be beneficial for improving the performance of players. Special care is needed in the analysis and continuous adjustment of training methods to ensure the continuous progress of athletes.

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