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DINCĂ Alin Răzvan

**GOALKEEPER TRAINING IN FOOTBALL BASED ON THE
APPLICATION OF THE GPEXE SOFTWARE**

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Composition of the Commission for public defense of the doctoral thesis:

1. **BRANIȘTE Gheorghe**, PhD in pedagogical sciences, university professor, Institute of Physical Education and Sport of MSU – president
2. **CIORBĂ Constantin**, dr. habil. in pedagogical sciences, university professor, "Ion Creanga" State Pedagogical University of Chisinau – scientific coordinator
3. **SÎRGHI Serghei**, PhD in pedagogical sciences, associate professor, Institute of Physical Education and Sport of MSU – official reviewer
4. **POTOP Vladimir**, dr. habil. in physical education and sport, university professor, National University of Science and Technology "Politehnica" Bucharest, University Center of Pitesti, Romania – official reviewer
5. **MIHĂILĂ Ion**, PhD in physical education and sport, university professor, National University of Science and Technology "Politehnica" Bucharest, University Center of Pitești, Romania – official reviewer

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President of the Public Defense Commission

Braniște Gheorghe,

PhD in pedagogical sciences, university professor

Scientific coordinator

Ciorbă Constantin,

dr. habil. in pedagogical sciences, university professor

Author

Dincă Alin Răzvan

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CONCEPTUAL GUIDELINES OF THE RESEARCH

The topicality. The football game has been and remains one of the most popular sports in the vast majority of countries on all continents. It is no coincidence that the largest football forums in the world are watched by millions of people of different ages. This makes this sport practiced by an impressive number of people, both at the amateur and professional levels.

Football is a team sport, where competitive and training objectives are solved jointly, depending on the tasks set for one or another team. Being a team game, each player on the field has his/her functions, and mostly football specialists [2, 6, 8, 10, 13, 18, 22, 29] classify them into: goalkeeper, defenders, midfielders and forwards.

Analyzing the results of several scientific and practical-methodical researches related to the training of football players [11, 16, 19, 21, 24, 26], it is clearly observed that most of them are dedicated to the collective training of football teams. Although, in recent years, some researches related to the differentiated training in the game of football have appeared, especially in juniors, there are practically no researches that would target the training of goalkeepers in the game of football, given the fact that they often consider themselves the key player of any team. The safety of the goalkeeper's game greatly depends on both the outcome of a match and the outcome of a tournament or a long-term competition.

As mentioned by the authors Muscă A. [15], Sîrghi S., Carp I. [20], Guba V., Lecsacov A. [26] and others, the goalkeeper's game, in terms of its content, differs greatly from the content of the game of football players on the field, he must have a complex sports training with a very voluminous special technical-tactical arsenal. The main task of the goalkeeper is to defend the goal by preventing the opponent from scoring, to have a very good reaction speed and a well-calculated coordination of movements. The goalkeeper is the safest player on the field, as he does not have the right to the slightest mistakes, and a mistake of his can lead to the loss of a match, a tournament, or a competition in general. In addition to playing safely in goal, the goalkeeper is the player who must be able to direct the actions of the players on the field, especially in the defensive zone.

Unfortunately, the analysis of the latest publications on the issue of goalkeeper training in football has shown that they are very limited and in most cases are treated as a complex training with the entire team. Although, following the training process of performance teams, we notice that most of them have qualified coaches specialized in goalkeeper training.

In the last few years, digitalization has increasingly penetrated various spheres of all fields of activity, including performance sports. Today, no world-wide competition is held without the application of digital equipment. It is worth noting that most of the time during competitions, including in sports games, digital equipment is used as a means of objectifying refereeing, that is, strictly observing the rules of the game.

However, in many cases, digital equipment can also be applied as a means of sports training, this being mentioned by several specialists [3, 12, 18, 24, 34] both in the field of football and other sports events.

In this context, it is proposed to apply the GPEXE software in the training of footballers for the position of goalkeeper. Even though this software has already been implemented in the practice of training footballers at various stages of training, it has mostly been applied to footballers on the field and has very rarely been used in the process of training footballers for the position of goalkeeper.

Thus, the research direction proposed by us is quite current and absolutely necessary for the theory and practice of sports training in the football game.

Description of the situation in the research field and identification of research problems

It is worth noting that the game of football is in a permanent succession both in quantitative and qualitative terms, becoming very fast, with many technical-tactical actions executed at maximum possible speed. Thus, the interest of football specialists has increased greatly at all levels, and this is confirmed by the appearance of several publications [2, 6, 15, 16, 22, 26, 31, 36] related to the quality of football players' training at the current stage.

Most specialists have been and are concerned with researching the efficiency of sports training in terms of motor, technical and tactical aspects. Thus, Oancea V. [16], Stoica D. [21, 22, 23], Pașcenco A. [29] and others have been concerned with the problem of optimizing the motor and technical-tactical training of football players of different ages and at different stages.

As mentioned above, in recent times, in most sports events, including football, digital technologies have been increasingly applied, being used both in terms of sports training and in the process of organizing and conducting sports competitions.

If we analyze the research results of several local and foreign specialists, most of them apply differentiated training depending on their level of sports training and very few works are dedicated to differentiated sports training by playing positions, especially of senior football players. Although such works are relatively rare, they are focused on the training of players on the field and very little refers to the training of goalkeepers in the game of football, even though it is known that the goalkeeper is the pillar player of each team and the success of one or another team depends largely on his playing efficiency.

Even though there are several publications related to the training of football players as goalkeepers [17, 35, 36, 37], practically very few of them focus on the use of digital equipment, the efficiency of which has been discussed quite a lot. In this sense, we proposed to implement the GPEXE software in the practice of sports training of senior football players as goalkeepers, this having already been tested quite thoroughly with football players on the field, being simple to implement and quite informative regarding the game actions performed by them.

The research problem consists in insufficient research on the use of digital equipment in the preparation of senior footballers as goalkeeper, and the application of GPEXE software will increase the level of sports training, but also their playing efficiency.

Research hypothesis. It was assumed that the application of the GPEXE software in the training of senior football players for the position of goalkeeper will contribute to increasing the level of their sports training, which is expressed by:

- Increasing the qualitative level of the game,
- Increasing the level of their motor training,
- Increasing the level of development of the coordination capacities specific to the goalkeeper in the football game.

The purpose of the research is to investigate the effectiveness of applying the GPEXE software in the sports training of senior football players in the goalkeeper position.

Research objectives:

1. Analysis and generalization of the specialists opinions regarding the optimization of sports training at the senior level.
2. Classification of the game actions of senior football players in the goalkeeper position.
3. Assessment of the sports training level of senior football players in the goalkeeper position.
4. Development and implementation of the experimental sports training program for senior football players in the goalkeeper position by applying the GPEXE software.

5. Experimental argumentation of the efficiency of implementing the experimental sports training program for senior football players in the goalkeeper position based on the application of the GPEXE software.

The novelty and originality of the research lies in the optimization of the sports training process of senior football players in the goalkeeper position based on the application of the GPEXE software. In this regard, an experimental program was developed with specific means for the training of senior football players, in this case, of football players in the goalkeeper position. This indicates the differentiated training of senior football players in the goalkeeper position through the application of the GPEXE digital software.

The scientific problem of major importance solved in this research lies in the need to optimize the differentiated training system of senior footballers, the emphasis being on the sports training of the players on the goalkeeper position. The role and importance of footballers as a goalkeeper is well known in the football world, this being the last hope of the team on the defensive, and the level of its sports training depends very much on the fate of a game action or the entire match.

The theoretical significance of the study consists in the development and implementation in the training process of senior football players in the goalkeeper position of an experimental program using the GPEXE software, which is approved by the competent authorities in the game of football internationally. The implementation of this program aims to increase the sports performance of football players, especially football players in the goalkeeper position.

The applied value of the work lies in the fact that the results obtained in the research can be used as methodological support by football coaches within specialized sports clubs, who are particularly specialized in training football players for the position of goalkeeper.

THESIS CONTENT

1. Theoretical and methodological guidelines regarding sports training in the football game

In the theory and methodology of physical education and sport the term sports training was introduced at the beginning of the twentieth century, with the beginning of the great transformations in the field of sports, with the more active start of the Olympic Movement.

Thus, the notion of sports training is not new, it has been defined by several local and foreign researchers, in different contexts [1, 4, 5, 9, 25, 27, 28, 30, 32].

In fact, the term "training" comes from the English word "training", which actually means exercise. The notion of training is defined in several variants, and in essence they do not differ much from each other.

With the development of the theory and practice of modern sports training, several terms have been drawn that describe or clarify the essence of sports training. Thus, Curamșin I. [28, p. 344] argues that sports training is an organized pedagogical process of sports improvement, which aims to develop certain qualities, motor skills and the formation of theoretical knowledge necessary to achieve the highest performance in a sports event.

Dragnea A., quoted by Ciolcă S. [7, p.9] mentions that sports training is "a pedagogical process carried out systematically and continuously, gradually, to adapt the human body to intense physical and mental efforts, involved in participating in competitions organized in different sports branches".

Bompa T.O. and Gregory G. [4, p.4] mention that "training is a process by which an athlete prepares for the highest possible level of efficiency", here a more global problem is materialized, with the emphasis on sports performance.

Triboi V. [25] define sports training as a planned pedagogical process, which includes the technical, tactical and motor skills training of the athlete.

Therefore, after analyzing several concepts, we come to the conclusion that sports training is nothing more than a sports preparation system, organized through several components such as biological, motor and psychological, depending on age and gender, and the ultimate goal being achieving sports performance.

Modern football is a very fast-paced game with a lot of physical contact, and this in turn places increased demands on each player, regardless of their playing position and their functions on the field. When we talk about increased demands on each player, we refer to the functions of each player, in each playing position, and the coordination of the game between players in all playing positions ensures the quality, or even the outcome of a game or a tournament.

Football is a team game in which several players participate, performing different roles on the field. Accordingly, the training of each of them requires taking into account various factors, namely the individual goals in the game for each player. In training lessons, the individual capabilities of each player must be taken into account and used as much as possible. It is absolutely necessary to ensure the development of qualities specific to his role, taking into account the possibility of interaction and changing roles of players.

In this research we will analyze the essence and basic requirements for one of the most important playing positions in football, such as the Goalkeeper. The decisive role and increased contribution of the goalkeeper in a team's game impose increased requirements on his training methodology.

Current research in the game football has accumulated a considerable amount of experience regarding the training of goalkeepers at various stages until they reach sporting mastery. However, the issue of the methodology of training footballers for the position of goalkeeper is still not sufficiently studied.

The modern football game places major demands on the goalkeeper's play, not only in his basic role as a goalkeeper, but also in his ability to perform various technical and tactical actions, mostly in the 16-meter box. The goalkeeper's location, being a very advantageous one, allows him to carefully follow all the actions on the field, and this requires the goalkeeper to direct certain actions of the players on the field. Thus, the successful conduct of the game, and sometimes even the final result, often depends on the goalkeeper's actions.

The methodology of training football players for the goalkeeper position must be very effective, based on the specifics of his actions on the sports field. The level of physical effort, intensity and duration of physical effort will always be increasing, based on the level of his sports training.

Technical progress today is increasingly felt in the process of training and competition of athletes of any level. Today, almost no sports event is held without the involvement of information technologies [12, 18, 29, 33].

The football game, being the most popular sports event, more and more specialists propose different experimental methodologies for optimizing the training process, starting with the initiation period and ending with the seniority age.

Thus, in the specialized literature [2, 7, 13, 14, 16, 22, 24] several digital methodologies related to the sports training process of football players of different levels have appeared. One of these is the application of the GPEXE System.

This system is quite easy to use, through the GPEXE web application, where the coach can benefit from more operational information for each player on the field, or those in the goalkeeper

position. In the most common cases, coaches can monitor the speed and position of the player on the field, this takes into account anaerobic effort and provides the coach with the real situation regarding the high volume of energy demand with reference to accelerations, sprints, and others, which creates a clear picture for the coach regarding the balance between physical effort and rest, between effort and recovery of the athlete.

It is worth mentioning that this software can be successfully applied in other sports events, especially team events, which would lead to higher efficiency in the qualitative training of athletes in terms of motor skills, but also physiology.

Therefore, digitalization is increasingly gaining ground in performance sports, this being true both for optimizing the training process and for an objective conduct of sports competitions of different levels, and this inevitably leads to the popularization of various sports events, the active involvement of young people in practicing various sports events, which ultimately will lead to improving the level of development and physical training of the younger generation.

2. Research methodology. The content of sports training of senior football players in the goalkeeper position

Researching the problem of training high-performance football players for the goalkeeper position, several **scientific methods** known in the sports academic environment were used, such as:

1. Analysis and synthesis of the bibliography in the field of football
2. Pedagogical observation
3. Testing method.
4. Survey method.
5. Pedagogical experiment.
6. Statistical-mathematical methods.
7. Graphic and tabular method.

The research was organized with the goalkeepers of the teams in the Iranian National Championship, where 15 top goalkeepers from sports clubs in Iran were involved, these being three goalkeepers from each of the clubs: ESTEGHLAL FC, PERSEPOLIS FC, TRACTOR FC, SEPAHAN S.C and FOOLAD FC.

The experiment was a longitudinal one, meaning only with an experimental group, where initial and final data were recorded, without having a control group, given the fact that at the level of sports performance, firstly, the number of players on the goalkeeper position is quite small, and secondly, when we refer to performance, coaches do not risk subjecting certain experiences to the players of the national championship teams, some of whom are also members of the Iranian national team.

The experiment was carried out in three stages, as follows:

Stage 1 – 2021-2022 – selection of subjects for the organization and conduct of the pedagogical experiment. Selection of bibliography with reference to the sports training of football players in general and in the goalkeeper position, in particular.

Stage 2 – 2022 -2023 – planning and organization of the ascertaining experiment, which highlighted the content of the actions of football players in the goalkeeper position in the highest level competitions.

Stage 3 – 2023 -2024 – Planning and organization of the pedagogical experiment regarding the sports training of football players in the goalkeeper position by applying the GPEXE Software.

In our research, one of the main objectives was to highlight the opinions of football specialists regarding the role and importance of players in the goalkeeper position. We were also interested in

some methodological aspects related to the training process of football players in the goalkeeper position.

In this respect, a survey was applied among coaches, which number 134 people, mostly those working with senior footballers, both in the country and abroad. In total, they were asked a set of 16 open-ended questions, where they could choose, or propose an answer option that they considered correct, or at least coincide with their opinion. The questions in the questionnaire were selected and presented on the general to particular principle, with a broad description of each response variant.

All results were statistically processed and are presented in the form of tables and figures in the experimental subchapter of the thesis, as well as in the annexes.

Analyzing the results of the opinions of specialists regarding the use of digital equipment, in this case of the GPEXE software, in the training of football players as goalkeepers, it was demonstrated that for the most part the specialists consider the use of digital equipment in the training process and in game conditions to be appropriate and effective. At the same time, many of them do not use, or occasionally use digital equipment in the training of goalkeepers in the football game. The causes of this phenomenon are different, either the lack of equipment, or ignorance of the existence of such equipment.

As a conclusion regarding the opinions of specialists about the sports training of senior football players in the goalkeeper position through the application of digital equipment (GPEXE Software), it results that this is a relatively new and little studied methodology, and players in this position need well-thought-out training from all points of view, resulting once again from the role of players in the goalkeeper position in a match, or a tournament in general.

Following the actions of a goalkeeper in the game of football, we notice that he must have a number of special motor qualities due to the content of his activity at the given function, which is actually the last player in any defense system of any team. It is not by chance that the goalkeepers are the tallest, most mobile players with a good attitude and strong spirit of anticipation of the game situations.

If the actions of football players in the positions of defenders, midfielders and forwards differ more or less in content, then the goalkeeper's position is absolutely different and requires from the players in this position a specific, quite concrete and specialized training in certain actions. To date, there is no definitive classification of all the goalkeeper's game actions, although many elements and technical procedures are found in several descriptions of the playing technique of football players in the Goalkeeper position.

Analyzing several specialized bibliographic sources related to the classification of the playing technique of football players in the goalkeeper position, we find their division into technical actions in attack and technical actions in defense, even if they participate in such actions to a lesser extent compared to the players on the field in the other positions. At the same time, the activity of the entire team depends greatly on the actions of the goalkeeper, as he is the last player in defense, and the fate of an episode, or even the entire game, depends on the quality of the goalkeeper's play.

Both attacking and defending play depend heavily on the goalkeeper's actions with the ball, but also without the ball. Speaking of actions without the ball, here we refer to the basic position, which is important for both the preparation and execution of attacking and defending play actions.

In this context, the actions of the goalkeepers of the teams participating in the semi-final and final games of the Europa League (2023) were analyzed. Here, all the actions of the players in the goalkeeper position under game conditions were analyzed, these were statistically processed, and their qualitative and quantitative results are described below.

Thus, a classification of the actions of senior football players in the goalkeeper position was developed (Figure 1), where all the criteria existing in the specialized literature were analyzed, moreover, actions that were not provided for in several other existing classifications were also introduced.

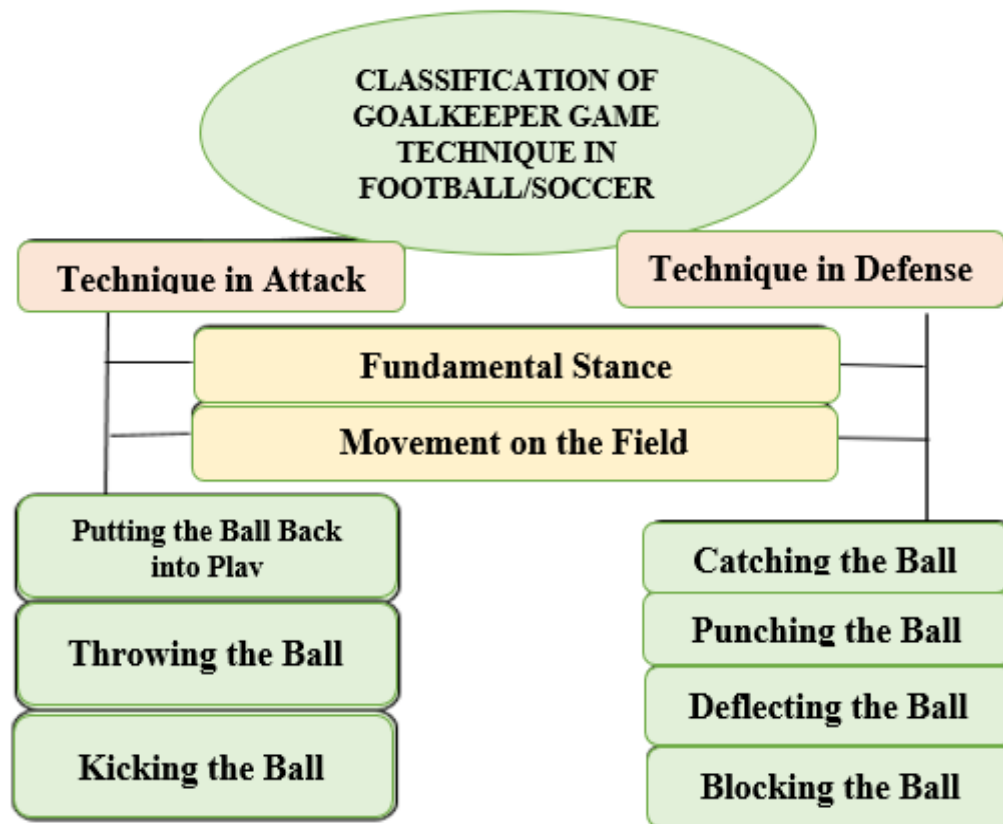


Fig. 1. Classification of the playing technique of football players in the goalkeeper position

The purpose of this analysis is to highlight the most requested actions of football players as goalkeepers in the game of football, while identifying their number, i.e. the quantitative part, and the efficiency of their performance, i.e. the qualitative part.

In order to analyze both the quantitative and qualitative parts of the goalkeepers' game actions, they were compared with certain standards, i.e. with the results of goalkeepers from the largest football teams on the European continent (Europa League), compared to those of goalkeepers from the Romanian National Football Championship and footballers from the Iranian Championship.

Thus, according to the above, the goalkeeper's actions were analyzed in ten games from the final part of the Europa League, the year 2023, the goalkeeper's actions in ten halves of the Romanian Championship, as well as the goalkeeper's actions in ten halves of the Iranian Championship, the athletes of this country actually constituting the groups participating in the basic pedagogical experiment, that is, the formative experiment. According to the classification made, the basic element among all the actions of the footballers in the goalkeeper position is "catching the ball", this in fact being the basic function of a goalkeeper in the game of football (Table 1).

Table 1. Number of executions of the "catching the ball" element by players in the goalkeeper position

Procedures	Variants of procedures	Competitive forums		
		Europa League	Romanian Championship	Championship of Iran
From a static position	Upper	1,68	1,24	1,03
	Bottom	1,57	1,44	1,26
	On your belt	1,18	1,08	1,03
In dynamics	From a dive	2,32	2,01	1,75
	Running	1,09	1,03	0,72
	From jumping	2,31	2,16	1,95
Total		10,15	8,96	7,74

If we analyze the total number of executions of this procedure such as "catching the ball", it largely depends on the dynamics and aggressiveness of the games in different competitions. Thus, according to the table above, the total number of executions of this element is proportionally decreasing at different levels, ranging from 10.15 catches in the Europa League, to 8.96 in the Romanian Championship and 7.64 in the Iranian Championship.

Thus, analyzing the number of goalkeepers' executions of game procedures at different levels, it is clearly observed that they do not differ much in number from one procedure to another, their number largely depends on the intensity and stakes of each game.

Another fairly widespread element performed by footballers in the goalkeeper position is "blocking the ball" (Table 2). This procedure is mostly performed in conditions of space and time crisis, when the goalkeeper has very little space between him and the attacker who performs the shot at the goal and obviously, in this case the goalkeeper has very little time to make a decision regarding the defense of the goal, and he resorts to blocking the ball with any part of the body.

Even if the goalkeeper is entitled to block the ball with any part of the body, in the classification of the actions of the footballers as goalkeeper, the blocking procedures of the ball were divided into three procedures most common in goalkeepers, these being: blocking the ball with the body, blocking the ball with the arms and blocking the ball with the legs. All of these have been further divided into two groups, such as from a static and dynamic position (by falling, or from a dive).

Table 2. Number of executions of item „blocking ball” by players as goalkeeper

Procedures	Variantes of procedures	Competitive forums		
		Europa League	Romanian Championship	Championship of Iran
With the body	By falling	0,75	1,25	1,38
	From a static position	2,13	2,06	2,37
With arms	By falling	1,28	1,22	1,36
	From a static position	3,14	3,46	4,12
With legs	By falling	1,86	2,03	2,14
	From a static position	2,38	3,01	3,27
Total		11,59	13,03	14,64

In this case, an inverse dynamic is observed, compared to the element "catching the ball", where the number of ball blockages is increasing, that is, the higher the level of competition, the lower the number of executions of this element.

Another quite frequent procedure used by goalkeepers is "ball deviation", this being applied in cases when the goalkeeper does not have enough time to take possession of the ball, or the game situation is difficult for the goalkeeper, and he is forced to deflect the ball from its trajectory towards the goal (Table 3).

Table 3. Number of executions of the item „ball deviation” by goalkeeper players

Procedures	Variantes of procedures	Competitive forums		
		Europa League	Romanian Championship	Championship of Iran
By hand	From a static position	2,15	3,22	3,57
	By jumping	5,26	4,12	3,78
With the foot	From a static position	2,26	3,14	3,98
	By jumping	3,45	2,67	3,58
Total		13,12	13,15	14,91

According to the classification of technical processes of the elements and technical procurements of the goalkeepers, the most frequent deviations are carried out by two processes, these being hand/hand deviation and foot/foot deviation, both of which are in turn divided into deviations from the static position and deviations from the jump/from a dive, that is, dynamic. If we look at hand deviations, their number decreases depending on the level of competitions, where in the Romanian Championship the average of performing this process is 4.12 times, and in the Iran Championship 3.78 times.

What is related to the ball deviation with the foot, this process is applied in cases when the ball is hit towards the goal with a fairly high speed, and the goalkeeper fails to reconsider with his hands and is forced to divert the direction of the ball with his foot or feet, depending on the situation of the game.

Therefore, in this case there is no law regarding the application of this technical process of goalkeepers, however, there is a slight tendency towards increasing the number of foot deviations from the static position, this underlining the lower intensity of matches in the championships with a lower level of football, such as that of Romania and Iran, compared to the League of Europe.

A fairly common technique used by goalkeepers in the game of football is the so-called "boxing the ball", which is performed with the fist(s) of the hand or hands, again depending on the game situation (Table 4).

This way of defending the goal is applied when the shots were strong at the goal, or in the direction of the goal, and the goalkeeper cannot risk catching the ball, not being sure that he will be able to take possession of it and in this case, the goalkeeper performs the so-called "boxing" of the ball, either changing direction to outside the field, or returning the ball to the field. As mentioned above, "boxing the ball" can be performed with one hand or with both hands, usually the hands being clenched into fists, all of this being possible to perform from a static position or in motion, either directly from the front, or from above, or by a lateral dive, etc.

Table 4. Number of executions of the "boxing the ball" element by players in the goalkeeper position

Procedures	Variantes of procedures	Competitive forums		
		Europa League	Romanian Championship	Championship of Iran
With one hand from a static position	Upper	1,06	1,23	1,36
	Forward	0,53	0,22	0,14
With a moving hand	From a lateral dive	1,47	1,05	0,78
	From jumping up	2,04	2,58	1,86
With both hands from a static position	Upper	0,16	1,03	1,07
	Front	0,76	1,45	1,32
With both hands in motion	From a lateral dive	0,78	1,07	1,54
	From jumping up	1,12	1,47	1,23
Total		7,92	10,1	9,3

If we analyze the executions of both technical procedures, in the most frequent cases, there is no clear trend in the number of executions of the different technical procedures depending on the competitive level.

The last element of the game of the footballers in the Goalkeeper position subjected to analysis was "putting the ball back into play", this element being possible to execute both with the foot and with the hand (Table 5).

Table 5. Number of executions of the "put the ball back into play" procedure by players in the goalkeeper position

Procedures	Variantes of procedures	Competitive forums		
		Europa League	Romanian Championship	Championship of Iran
By hand	At a short distance	2,35	3,17	3,26
	At long distances	3,28	2,57	3,06
With the foot	From the 6m square	4,78	5,73	4,89
	From the game	7,15	5,23	4,52
Total		17,56	16,70	15,73

Analyzing games from different competitions, it has been demonstrated that at all levels there is a clear tendency for goalkeepers to be involved in the game as a defender, especially when pressure is put on the team's defense, which is often forced to use the pass back to the goalkeeper, who is then to introduce it into the game. In this case, the goalkeeper must be able to pass to his teammate with precision, to debate the ball on the field with precision, that is, to fully fulfill the functions of a defender.

Therefore, the higher the level of competitions, the more often this goalkeepers' playing method is applied. In fact, there are other factors that force teams to play from the defense, here we refer to the conditions when one team or another is in limited playing time and the score is not favorable for it, when one team or another wants to "freeze" the score, and the opposing team is constantly attacking them. In this case, the defending players are put in a situation where they are forced to return the ball

to the goalkeeper in order to create priority for the defending players. This happens less often in teams with a lower level of sportsmanship, they immediately switch to attacking actions, without returning the ball to the goalkeeper.

We reiterate that even though there are some rules regarding the way goalkeepers intervene in the game of football, their actions largely depend on the game situations, the score of the game, the stakes, and other factors.

3. Experimental validation of the efficiency of applying GPEXE software in training footballers as goalkeepers

The training of football goalkeepers is a key component of the defensive capabilities of any team, and the safety of his actions increases and strengthens the fighting force of the entire team. The goalkeeper plays in the hottest zone in front of the goal, where the fight between attackers and defenders reaches its limit. All components of the football player's skill must meet certain standards, where they must be well-trained athletically, tall in height, with a special detente, which gives him special advantages when playing in the penalty area, be able to get ahead of the opponent, stop and catch the ball in any position, or debate it with his fist or fists.

Currently, there are several methodologies for effective sports training of football players, regardless of their age and level of training. However, recently, the specialized digital program GPEXE, which represents a new generation of recording of players' actions in the game of football and beyond, has been enjoying great popularity.

Within the experimental program, all goalkeeper footballers included in the pedagogical experiment lasting one calendar year used this GPEXE software, both during the training period and during the competition and recovery periods. This software has several advantages such as:

- The operability of information about the goalkeeper's actions during the match.
- The number of actions performed by the goalkeeper online.
- The duration of physical effort.
- Graphic expression of the goalkeeper's game actions.

Speaking about the planning of the sports training of goalkeepers, it is worth mentioning that this is a traditional one and does not differ at all from the experimental one that we propose, except that in this case, the GPEXE software will be applied throughout the athletes' training.

With reference to the volume of hours for training football players as goalkeepers, in the training program, we focused on several types of training, allocating a number of hours for each of them, depending on the competitions planned for the experimental year, the level of sports training of the goalkeepers included in the pedagogical experiment and other objective factors (Table 6).

According to the content of Table 6, it is clearly observed that the number of hours allocated for the types of training is approximately constant throughout all training periods. The largest number of hours is related to general and specific physical training. Here, in fact, it is not about increasing the level of motor training, but about maintaining the physical level of athletes throughout the competition period, given that in the game of football the competition period can last up to 4-5 months.

Thus, the total number of hours provided for the training of goalkeepers is approximately 800-820 hours, depending on the content of the domestic and international competition calendar. The content of the planned training can be rectified, modernized, depending on the situations that arise in the training process, as well as the purpose and objectives set before the team by the coaches.

Table 6. Distribution of players' training hours as goalkeeper for one calendar year

No	Types of training	Total hours	The months											
			09	10	11	12	1	2	3	4	5	6	7	8
1.	Physical training	152	12	12	12	12	16	12	12	12	12	12	16	12
2.	Tactical training	158	16	16	16	16	0	14	16	16	16	16	0	16
3.	Technical preparation	100	10	10	10	10	0	10	10	10	10	10	0	10
4.	Theoretical and psychological preparation	50	6	6	6	6	0	6	4	4	4	4	0	4
5.	Full preparation	242	24	24	24	24	0	26	26	24	24	24	0	22
6.	Participation in competitions	74	8	8	8	8	0	4	6	8	8	8	0	8
7.	Rehabilitation measures	40	4	4	4	4	0	4	4	4	4	4	0	4
8.	Testing	12	4	-	-	-	-	4	-	-	-	-	-	4
Total hours		828	84	80	80	80	16	80	78	78	78	78	16	80

According to data from several football specialists, the training of players for the goalkeeper position can be carried out in two ways, using both individualized training, with specific means for the goalkeeper position, as well as the training of the goalkeeper within the team (Table 7), given that the goalkeeper is often required to perform the functions of the player on the field, in cases when he leaves the goal, where he is allowed to play the ball, including with his hands, or any part of the body.

Table 7. Report of individual and team training time of goalkeepers, %

Stages and cycles of preparation		Individual training	Team training
Preparatory stage	1st weekly microcycle	30	70
	2nd weekly microcycle	30	70
Pre-competition stage	1st weekly microcycle	40	60
	2nd weekly microcycle	40	60
Competitive stage	1st weekly microcycle	35	65
	2nd weekly microcycle	35	65
Average in %		30	70

The preparatory period of the performance teams is quite short in terms of time and varies from 4 to 6 weeks. The specifics of the competitive activity of goalkeepers, the individual character of their main technical and tactical actions have determined the methodological emphasis on the individualization of the sports training of goalkeepers at all stages of training.

Thus, according to Table 7, the trend of individual and team training of goalkeeper players is clearly observed, where with the transition from the preparatory stage, to the pre-competitive stage and then to the competitive stage, the share of hours allocated for the goalkeepers' sports training varies quite a lot. If at the preparatory stage the ratio of individual and team training was 30 to 70%, then at the pre-competitive stage this ratio was 40 to 60%, and at the competitive stage – 35 to 65%.

We note that at the competitive stage, team training is about 65%, this being explained by the need to coordinate the game actions between the players on the team, mostly the defensive players, and the goalkeeper. Thus, if we analyze the weight of individual and team training, in most cases it will be on average 35% - individual training and 65% - team training.

Again, this ratio is not a very strict one and can vary depending on several factors, such as the level of sports training of the goalkeepers, their functional state, the way they fit into the game and others.

From the data presented in the tables above, it is clear that the individual training of a goalkeeper, according to the experimental program, involves an emphasis on the development of the goalkeeper's specific motor qualities.

The full training program for senior goalkeepers is presented in the annexes, which was implemented during a competitive year, and the qualitative and quantitative results are presented in the following subchapters.

One of the main objectives of the research undertaken was to highlight the efficiency of the implementation of the experimental program regarding the quality of goalkeeper training. Thus, in the second chapter of the thesis, the quantitative contribution of the technical elements and procedures performed by goalkeepers during a match was investigated. Within the formative experiment, we monitored the efficiency of their execution in quantitative and qualitative terms, comparing the initial and final results of the goalkeepers included in the pedagogical experiment.

For starters we will analyze the qualitative indices of execution of one of the most important processes of playing footballers as goalkeeper, this being „catching the ball”, this in fact, being the basic function of a goalkeeper (Table 8).

Table 8. Efficiency of element execution „catching the ball” by players as goalkeeper

Procedures	Variante of procedures	T.I. X ± m	T.F. X ± m	t	P
From a static position	Upper	1,14 ± 0,33	2,31 ± 0,41	2,21	<0,05
	Bottom	1,22 ± 0,32	1,07 ± 0,43	0,28	>0,05
	On your belt	1,12 ± 0,56	1,33 ± 0,64	0,25	>0,05
In dynamics	From a dive	1,46 ± 0,37	2,47 ± 0,27	2,20	<0,05
	From running	0,84 ± 0,08	0,96 ± 0,06	1,22	>0,05
	From the jump	2,32 ± 0,51	4,23 ± 0,67	2,27	<0,05

According to Table 8, the "catching the ball" procedure can be performed from two basic positions, these being from the static and dynamic position, i.e. walking, running or jumping. In both cases, we divided the goalkeepers' actions into three more execution variants for each position. Thus, from a static position, the number of goalkeepers' interventions is quite low in a football match, where catching the ball from above from a static position on average at the initial testing was 1.14 catches of the ball. At the end of the experiment, their number doubled, but it was equally modest, reaching an average of 2.31 catches of the ball. If we compare the two results, initial and final, we observe a statistically significant increase only in the "catching the ball from a static position from above" procedure ($P < 0.05$). Otherwise, the number of goalkeepers' actions, even if it increased slightly, the differences are not significant in this regard. For example, in the case of catching the ball from a static position from below and from the waist, the final results, even if they were higher, the differences are statistically insignificant ($P > 0.05$).

Among the three dynamic ball catching procedures, a significant increase in the number of executions by goalkeepers is observed only in the case of "jumping ball catching", where in the initial testing, goalkeepers on average performed 2.32 ball catches, and in the final testing, their number increased to 4.23 ball catches ($P < 0.05$).

The number of diving ball catches also increased quite a lot, almost doubling, but statistical calculations have shown that this difference is not statistically significant ($P>0.05$). The same is observed in the case of running ball catching, where in the initial testing, goalkeepers caught the ball 0.84 times, and in the final testing, their number increased to 0.96 times ($P>0.05$).

Thus, if we analyze the overall results of catching the ball by the players in the goalkeeper position at the beginning and end of the formative experiment, we notice that their number at the end of the experiment, in most cases, increased, but the difference between the initial and final results was not always significant. These results, to a large extent, depend on the stakes of the game and the level of their sports training.

Another element quite often used by football players in the goalkeeper position is "ball blocking" (Table 9).

Table 9. Number of executions of the "ball blocking" element by players in the goalkeeper position

Procedures	Variantes of procedures	T.I. $\bar{X} \pm m$	T.F. $\bar{X} \pm m$	t	P
With the body	By falling	$0,83 \pm 0,06$	$0,87 \pm 0,04$	0,56	$>0,05$
	From a static position	$2,21 \pm 0,13$	$2,28 \pm 0,17$	0,33	$>0,05$
With the hands	By jumping	$1,24 \pm 0,33$	$2,46 \pm 0,31$	2,71	$<0,05$
	From a static position	$3,56 \pm 0,22$	$3,48 \pm 0,14$	0,36	$>0,05$
With the feet	By falling	$2,75 \pm 0,31$	$3,94 \pm 0,26$	3,05	$<0,01$
	From a static position	$2,42 \pm 0,36$	$2,31 \pm 0,17$	0,29	$>0,05$

According to Table 9, we observe that the element "blocking the ball" can be executed through three processes, here we are talking about blocking the ball with the body, blocking the ball with the arms and blocking the ball with the feet, and all of these depend on the game situations and the goalkeeper's way of intervening in one case or another. For example, when analyzing the goalkeeper's interventions with the body, this process can be performed by falling, or from a static position. It is worth mentioning that this type of ball blocking is executed in cases when the goalkeeper fails to gain possession of the ball to catch it and then, being in a time and space crisis, he is forced to block the ball with his body to defend his goal. This can be executed both by falling and from a static position, depending on the game situation at that time.

Analyzing the number of executions by the two procedures, we observe that in both cases they are not used very frequently in the goalkeepers' game, such situations not being very common in one game or another, which is why the differences in their execution are statistically insignificant ($P>0.05$). Thus, in the initial testing when blocking the ball with the body by falling, the goalkeepers recorded an average of 0.83 executions, while at the end of the experiment this indicator increased by only 0.03, being only 0.87 interventions of this kind.

Approximately the same trend is observed in the case of blocking the ball with the body from a static position, except that such interventions are encountered more often, either at the goal line or going out onto the field. For example, at the initial testing in the environment, such interventions were encountered approximately 2.21 times, while at the end of the formative experiment, this figure reached 2.28 blockages. As in the previous case, the difference between the final and initial result is statistically insignificant, which indicates the small number of such interventions.

According to the classification of the methods of blocking the ball with the hands, this element can be performed in two ways - by jumping and from a static position. If we analyze these data at the

initial testing and at the final setting, it is clearly observed that the most interventions of the goalkeeper were in the case of blocking the ball with the hands by jumping, the initial result being 1.24 blocks, and at the end - 2.46 blocks. Statistical calculations recorded a significant increase in the final results compared to the initial ones ($P < 0.05$), and this speaks of a greater intensity of the games at the end of the pedagogical experiment.

Regarding blocking the ball with their feet from a static position, in the initial testing, the goalkeepers intervened on average 2.42 times, and in the final testing – 2.31 times. It is obvious that in the first case the number of blocking the ball with their feet by jumping was much higher at the end of the experiment, and this speaks to the increase in the speed of the football players at the end of the experiment, where the goalkeepers had the opportunity to block the balls, mostly through various jumps, either vertically or in the form of a dive in one direction or another.

Another element quite common during football matches is "ball deviation" through various processes (Table 10).

Table 10. Number of executions of the item „ball deviation” by players as goalkeeper

Procedures	Variante of procedures	T.I. $\bar{X} \pm m$	T.F. $\bar{X} \pm m$	t	P
With the hands	From a static position	$2,52 \pm 0,08$	$3,25 \pm 0,07$	6,36	$<0,001$
	By jumping	$3,36 \pm 0,13$	$3,78 \pm 0,15$	2,10	$<0,05$
With the feet	From a static position	$2,87 \pm 0,08$	$2,42 \pm 0,07$	4,50	$<0,001$
	By jumping	$2,47 \pm 0,06$	$2,76 \pm 0,08$	2,9	$<0,05$

If we analyze the results of the ball deflection by the players in the goalkeeper position, we notice that their number at the end of the pedagogical experiment has increased significantly, this being demonstrated by statistical calculations. The relatively large number of goalkeeper interventions by “ball deviation” is explained by the increase in the intensity of the games, that is, by the increase in the speed of the game, which does not allow the goalkeeper to catch the ball, he being forced by the situation to deflect the ball, either on the field or outside it.

Another technical procedure, quite frequently applied by footballers in the goalkeeper position is “boxing the ball” (Table 11). This procedure is more frequently used in cases when the ball is not safe to catch and the ball has been hit very hard towards the goal, and it is inconvenient for the goalkeeper to take possession of it, and as a result, the goalkeeper boxes the ball.

Table 11. Number of executions of the "boxing the ball" element by players in the goalkeeper position

Procedures	Variante of procedures	T.I. $\bar{X} \pm m$	T.F. $\bar{X} \pm m$	t	P
With one hand from a static position	Upper	$1,67 \pm 0,06$	$1,72 \pm 0,04$	0,70	$>0,05$
	Forward	$0,63 \pm 0,07$	$0,71 \pm 0,08$	0,81	$>0,05$
With a moving hand	From a lateral dive	$0,78 \pm 0,08$	$1,14 \pm 0,09$	4,10	$<0,001$
	From jumping up	$2,78 \pm 0,14$	$2,96 \pm 0,17$	0,86	$>0,05$
With both hands from a static position	Upper	$1,54 \pm 0,16$	$1,83 \pm 0,13$	1,53	$>0,05$
	Forward	$1,86 \pm 0,14$	$1,72 \pm 0,15$	0,71	$>0,05$
With both hands in motion	From a lateral dive	$1,48 \pm 0,13$	$2,63 \pm 0,18$	5,48	$<0,001$
	From jumping up	$1,38 \pm 0,11$	$1,81 \pm 0,08$	3,31	$<0,01$

This procedure has several execution variants, depending on the game situations, and in most cases the given procedure has two basic variants, these being boxing with one hand and boxing with both hands, with one hand and with both hands, from a static and dynamic position, i.e. in motion. To begin with, we will analyze the number of goalkeepers' interventions with one hand from a static position from above and below, and here we will also refer to boxing the ball with one hand from the movement from above and from the side.

If we analyze the number of one-handed boxing from a static position from above, we notice that at the beginning of the experiment the goalkeepers intervened on average 1.67 times, while at the end of the experiment the number of interventions in this way increased only to 1.72 times ($P>0.05$). Thus, it is clear that this procedure is not applied often enough during matches, although goalkeepers must always be ready to use it in one or another game situation.

The results are different when we talk about boxing the ball with one hand while moving, either from a dive or by jumping up. This procedure is applied when the ball has been hit hard towards the goal and the goalkeeper fails to catch the ball and is forced to box it. In the first case, in the initial testing, the goalkeepers recorded an average of 0.78 executions, while in the end this average reached 1.14 boxings, which represents a statistically significant increase ($P<0.01$).

Approximately the same trend is observed in the case of one-handed jumping-up boxing of the ball, where in the initial testing goalkeepers performed this procedure on average 2.78 times, and at the end of the experiment they reached 2.96 boxings of this kind. Even if the difference between the initial and final testing is not statistically significant, the number of such executions is higher compared to other elements of goalkeeper intervention in the game.

Analyzing the results related to the boxing of the ball with both hands from a static position, we observe that there are several types of such boxing, however, the most widespread are those with both hands above and with both hands in front. In the first case, during the initial testing, the middle punches intervened 1.54 times, while at the end of the experiment this number increased to 1.83 interventions. Even though their number increased, this increase is not statistically significant ($P>0.05$), meaning that this procedure is applied quite rarely in different game situations.

The results are different in the case of boxing the ball with both hands in motion, where they are most frequently performed by lateral diving and jumping up. In the first case, at the initial testing, the goalkeepers recorded an average of 1.48 interventions, while at the end of the experiment their number almost doubled (2.63), which demonstrates the increase in the intensity of the game, where goalkeepers are forced to intervene through such a procedure. Statistical calculations demonstrated a significant increase in these ball interceptions ($P<0.05$).

Lately, analyzing several games of different levels, we notice that goalkeepers are increasingly involved in the game, which is why they must be quite prepared to intervene in the game as a field player, that is, to process the ball with their feet, depending on the game situations (Table 12).

Table 12. Number of executions of the "put the ball back into play" procedure by players in the goalkeeper position

Procedures	Variante of procedures	T.I. $\bar{X} \pm m$	T.F. $\bar{X} \pm m$	t	P
By hand	At short distances	3,19 $\pm$ 0,12	4,54 $\pm$ 0,21	5,61	<0,001
	At long distances	3,22 $\pm$ 0,13	3,89 $\pm$ 0,19	2,90	<0,01
With the foot	From the 6m square	4,96 $\pm$ 0,21	5,76 $\pm$ 0,34	2,01	>0,05
	From the game	4,88 $\pm$ 0,53	7,91 $\pm$ 0,61	3,74	<0,001

Analyzing several games of different levels, including the highest, such as European Cups, European and World Championships, a clear tendency is observed for footballers to play as goalkeepers, who must have universal training and be able to equally fulfill both their functions as goalkeeper and as a player on the field. When we mention this, we refer to the fact that goalkeepers are quite often put in a situation where they have to play the ball only with their hands or only with their feet, in both cases to put the ball into play with maximum precision.

Analysis of several games at the highest level has highlighted the fact that goalkeepers are increasingly involved in actions of introducing the ball into the field with their feet, and this requires appropriate training from goalkeepers. Such introduction of the ball into the game most often occurs in two forms, one from a standard position, usually introducing the ball from the 6-meter box and necessarily from the game, when the defenders, being pressured by the attackers of the opposing team, increasingly pass back to the goalkeeper, who in turn introduces the ball into the game.

The high number of kicks by goalkeepers demonstrates a clear increase in the intensity of the game, where defenders often have to return the ball to the defense zone, and eventually it reaches the goalkeeper, who will start the attacking actions of his team.

Thus, analyzing the actions of football players in the goalkeeper position, we can conclude that the goalkeeper is one of the basic figures in a football team, and the team's success in a match or tournament largely depends on the level of their sports training. For this, the players in the goalkeeper position will have a well-established program and will be carried out by a coach specialized in training goalkeepers. This program will be focused both on the technical and tactical training of goalkeepers, and on the sports training of the team where he will act as a field player.

One of the performance criteria in any sporting event, including football, is the level of their motor training. In the specialized literature with reference to the game of football, physical training is also divided into general physical training and specific physical training, i.e. specific indices of the motor training of football players. In the research conducted, we were particularly interested in how the indices of the motor training of football players in the goalkeeper position evolved, this being in fact one of the basic objectives of the research undertaken during a competitive year.

It is known that goalkeepers are the players with the highest demands on the level of motor training, they are also the players with the highest somatic indicators, here we are referring to waist, arm span, etc. Following the analysis of the activities of football players in the goalkeeper position, it was found that their activity is universal, with reference to their play as the last defender of the goal but also as a field player, when appropriate.

In order to verify the efficiency of the motor training of football players in the goalkeeper position, several general motor tests were selected, as well as those specific to the goalkeeper's activity, where all the motor qualities necessary for a player in the goalkeeper position are involved. The speed tests (30-meter run), the endurance test (Cooper Test), the strength test (lifting the trunk in 30 seconds), three strength tests in speed mode (standing long jump, lunge long jump, vertical jump), and three tests with different oxygen consumption regimes, either aerobic, anaerobic or intermittent aerobic (YO YO test, Gacon Test, Beep Test) were also analyzed.

All these tests were applied both at the beginning and at the end of the experiment, the results being statistically processed and presented in Table 13.

The experiment involved 15 goalkeepers, three goalkeepers from five teams in the Iranian National Championship, who are presented in the appendices of the paper. The experiment was a longitudinal one, since it is impossible to form two large groups of goalkeepers at the national championship level and to intervene with certain experimental programs in their training process.

Table 13. Indices of motor training of football players in the goalkeeper position

No	Control exercises	T.I. X $\pm$ m	T.F. X $\pm$ m	t	P
1.	Sprint, 30m, s	3,54 $\pm$ 0,04	3,32 $\pm$ 0,6	3,14	<0,001
2.	Leaning forward on the gym bench, cm	5,31 $\pm$ 0,25	6,22 $\pm$ 0,28	2,39	<0,01
3.	Cooper Test, m	3542,12 $\pm$ 3,61	3561,36 $\pm$ 4,48	3,34	<0,001
4.	Trunk lift in 30 s, no. reps.	26,12 $\pm$ 1,03	29,47 $\pm$ 1,05	2,36	<0,01
5.	Standing long jump, cm	2,87 $\pm$ 0,04	3,05 $\pm$ 0,07	2,25	<0,05
6.	Vertical jump, cm	74,73 $\pm$ 1,14	78,17 $\pm$ 1,21	2,07	<0,05
7.	Running jump, m	5,37 $\pm$ 0,26	5,48 $\pm$ 0,21	2,69	<0,01
8.	YO-YO test, aerobic-anaerobic	2335,28 $\pm$ 4,58	2352,17 $\pm$ 5,36	2,39	<0,01
9.	Gacon test, intermittent aerobic	2622,43 $\pm$ 5,41	2640,21 $\pm$ 5,37	2,34	<0,01
10.	Beep Test, aerobic	11,64 $\pm$ 0,17	12,23 $\pm$ 0,18	2,36	<0,01

Even though at senior age athletes cannot progress significantly in terms of motor skills, one of the main objectives of coaches at this level is to maintain physical fitness throughout the competitive period, which in football is quite long in duration.

The general conclusion regarding the motor training of the football players involved in the pedagogical experiment is that the application of digital methodologies in the training process, in the given case of football players in the goalkeeper position, did not negatively influence the level of their motor training. On the contrary, in all ten tests subjected to analysis the athletes improved their performance. This was clearly demonstrated both by the recorded results, but also by the statistical calculations, which allowed their theoretical and scientific argumentation.

One of the basic indicators for any footballer, including goalkeepers, is very important, if not decisive, the level of development of their specific skill. Speaking of skill, this actually represents the coordination capabilities of athletes, which are quite varied for a goalkeeper. If we are to refer to goalkeepers, analyzing the content of their activity, either in the training process or in the official game process, they are required to demonstrate several coordination capabilities, absolutely necessary for a goalkeeper, such as: the ability to react to stimuli, the ability to maintain balance; the ability to spatial orientation; the ability to appreciate and regulate dynamic, spatio-temporal and motor parameters; the ability to relax muscles autonomously and others. These capabilities can and must be developed and maintained constantly to be used in certain game situations, where it is necessary to intervene to gain possession of the ball, or to prevent the opponent from scoring in his goal.

The content of the experimental program for the sports training of goalkeepers presents several means for the development of their coordination capabilities, and the coach specialized in goalkeeper training can use them depending on the information received through the GPEXE software, depending on the physical condition of the athletes, their stage of training, etc. As mentioned above, the experimental program was applied during a competitive year with senior goalkeepers, and one of the main objectives of our research was to argue its efficiency, in this case by assessing the level of development of the coordination capabilities of the athletes involved in the pedagogical experiment.

In sports practice, there are several classifications of coordination abilities, but we focused on the classification of V. Platonov [30], from where we took over only those abilities that, according to the opinions of specialists, are absolutely necessary for a football player in the position of goalkeeper. Each coordination ability was analyzed through a control exercise, called a test, which they represent. Thus, the ability to react to stimuli was assessed through the optics test, the ability to maintain balance

through the Romberg Test, the ability to spatial orientation - the Square test, the ability to appreciate and regulate dynamic, spatio-temporal and motor parameters - the 2700 turn jump and the ability to relax the muscles autonomously through the Hand Dynamometry test. The results were recorded, statistically processed and presented in the form of a table and figures (Table 14).

Table 14. Indices of development of coordination capacities in senior footballers playing the goalkeeper position

No	Coordinative abilities	Control exercise	T.I. $\bar{X}1 \pm m_1$	T.F. $\bar{X}2 \pm m_2$	t	P
1.	Capacity for reaction to stimuli	Optic, s.	0,12 $\pm$ 0,02	0,07 $\pm$ 0,01	2,50	<0,01
2.	Capacity for maintaining balance	Static Balance "Romberg Test", s.	48,16 $\pm$ 1,12	53,13 $\pm$ 1,14	3,11	0,001
3.	Capacity for spatial orientation	Square Test, s.	10,15 $\pm$ 0,43	8,32 $\pm$ 0,56	2,61	<0,01
4.	Capacity for evaluation and regulation of dynamic, spatio-temporal, and motor parameters	Jump with 270° turn, degrees	12,07 $\pm$ 0,35	9,23 $\pm$ 0,44	2,28	<0,01
5.	Capacity for automatic muscle relaxation	Right hand dynamometry, kg	5,16 $\pm$ 0,24	3,86 $\pm$ 0,26	3,71	<0,001
		Left hand dynamometry, kg	7,21 $\pm$ 0,45	5,43 $\pm$ 0,47	2,74	<0,01

The content of the experimental program, presented in the annexes, is largely focused on the use of special means for the development of movement coordination in senior football players, either with objects or without objects, these being individual exercises for the development of movement coordination, exercises in groups and teams, having the same goal - the development of movement coordination.

In order to evaluate the level of development of the coordination capacities of football players in the goalkeeper position at the beginning and end of the pedagogical experiment, the athletes included in the pedagogical experiment were tested on several indicators, which are presented in the table above (Table 14).

Following the analysis of the results of the formative experiment related to the development of the skills of football players in the goalkeeper position, it was clearly demonstrated that this actually represents the level of development of the coordination capabilities of football players. In the theory and practice of physical education and sports, several classifications of coordination capabilities are found, and these are researched depending on the sports event and the objectives set before them. In this case, the main objective was to research the efficiency of developing the coordination capabilities specific to football players in the goalkeeper position by applying the GPEXE software.

Analyzing the results of the development of coordinative capacities at the end of the formative experiment, it was demonstrated that all the tested indicators improved significantly, this being confirmed by the statistical calculations presented in the tables with the recorded results.

The results of the formative experiment clearly demonstrated the efficiency of applying this digital software, which led to an increase in the level of development of coordinative capacities, which in fact represents the level of development of the specific skill of the footballers in the goalkeeper position.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

Following the organization of the scientific experiment on the training of senior football players as goalkeepers by applying the GPEXE Software, the following conclusions were formulated:

1. Analyzing the specialized literature on the issue of modernizing sports training at the current stage, it was found that most sports events increasingly apply various digital devices, either to objectify refereeing or to optimize the sports training process.

2. Data from the specialized literature in the field of football demonstrate a wide implementation of digital equipment in the training of football players at all levels, and their share is increasing, especially in the training process, demonstrating quite high efficiency, both in terms of quality and very operational completion time.

3. The results of the observational experiment allowed the creation of a classification of the technical elements and procedures of football players in the goalkeeper position, which is a broad one, encompassing all the elements and procedures of the goalkeepers' game, at the same time, without claiming to be absolutely complete. It can be supplemented, modified, depending on the purpose and objectives set before the specialist.

4. The analysis of the actions of football players as goalkeepers in different competitions of different levels has shown that the technical elements and procedures of goalkeepers of different levels are approximately the same, only the number of executions differs, and this is conditioned by the level of sports training of the teams participating in the competitions. Thus, analyzing the actions of goalkeepers in the Europa League competition, a greater number of actions is observed, compared to goalkeepers in the Romanian and Iranian Championships. This is due to the increased speed of the game, respectively the number of attacks on the goal is higher, the efficiency of the attackers is higher, which led to an increased number of technical elements and procedures for taking possession of the ball by goalkeepers.

5. The sports training of senior footballers in the goalkeeper position was carried out by applying an experimental program, by implementing the GPEXE software, which is widely used, both in training and in game conditions. The application of the GPEXE software allowed the operative recording of all the goalkeepers' game actions, highlighted the quality and number of their executions, which allowed the coach's operative intervention in making momentary decisions.

6. The results of the formative experiment demonstrated that the widespread use of the GPEXE software in the process of training football players for the goalkeeper position has considerably increased the qualitative and quantitative level of execution of the goalkeepers' technical elements and procedures during official competitions. Thus, due to the increase in the speed of play, the number of "catches" of the ball decreased and the number of "deflections" of the ball by goalkeepers increased, where at the final testing they made an average of 3.78 deflections, compared to 3.36 at the initial testing, this increase being statistically significant ($P < 0.05$).

7. Analyzing the results of the formative experiment using the GPEXE digital software in the training process of football players as goalkeepers, it was found that the number of goalkeeper interventions in one game or another depends on several factors such as: the level of sports preparation

of the teams, the stakes of the game, the situation in the competition standings, the teams' tactical game scheme and others.

8. The widespread use of the GPEXE software in the training of football players as goalkeepers has significantly influenced the quality of goalkeeper training, in most cases the number of goalkeeper interventions has increased significantly. As football becomes more aggressive, team defenders increasingly involve goalkeepers at the start of attacking actions, returning the balls to them, who in turn is obliged to perform the function of a defensive player. Thus, according to the analysis of the results of the formative experiment, the number of goalkeeper interventions as defenders at the end of the experiment on average was 7.91, compared to 4.88 at the beginning, this difference being statistically significant ($P < 0.01$).

9. The results of the analysis of official football competitions highlighted the fact that the game of football has become quite "aggressive", where teams are attacked right from the opponent's 16-meter box, and in this case the team in the defensive phase increasingly involves goalkeepers in the game actions, where they evolve as a field player, who is able to pass exactly to their partners, to be able to release the ball exactly to their partners in attack, and so on.

10. Analyzing the results of the formative experiment, it was found that the use of the GPEXE digital software in the training process contributed significantly not only to the number and quality of executions of technical elements and procedures, but also to increasing the level of development of basic motor qualities. The highest results were recorded in the speed strength tests evaluated by the "standing long jump" and "vertical jump" tests. In the first case, the average at the initial testing was 2.87 meters, and at the final testing - 3.05 meters. In the second case, at the initial testing, the athletes recorded averages of 74.73 centimeters, and at the final testing - 78.17 centimeters. In both cases, the increases were statistically significant ($P < 0.05$), which demonstrates the efficiency of the experimental program implemented in the goalkeeper training process.

11. We were particularly interested in the evolution of the coordination capacities of the goalkeepers following the pedagogical experiment, which are actually decisive for a goalkeeper. Thus, at the end of the pedagogical experiment, all the coordination capacities analyzed had a significant increase compared to the initial testing results. The most relevant results were recorded in the case of the capacities for reacting to stimuli, the ability to maintain balance and the ability to spatial orientation, where the final results were significantly higher compared to the initial ones, this being also demonstrated by statistical calculations ($P < 0.01$).

Thus, the important scientific problem in the field was solved, which aims to train football players as goalkeepers by applying digital means, in this case the GPEXE software, which led to the rapid recording of goalkeepers' playing actions, both in the training process and during official games, and the operative involvement of coaches in solving existing problems.

Following the organization and conduct of the pedagogical experiment with senior footballers specializing in the goalkeeper position, the following practical and methodological recommendations were formulated:

- The digital equipment will be selected and monitored by a digital specialist, in partnership with a football specialist, specializing in training footballers for the goalkeeping position.
- The equipment of the football players playing the goalkeeper position, participants in the experiment, will be one that will correspond to all the somatic parameters of the athletes, will be very

comfortable without hindering the goalkeeper's actions, either during training or during official games.

- Athletes will be informed in advance about the intentions and research plan envisaged by the coaches, and the need to apply specialized equipment and applied digital devices will be explained.

- All information related to the goalkeepers' actions in the training process, or in game conditions, will be recorded on a digital monitor and will be provided to the coach, either in digital or paper format.

- Coaches specialized in training goalkeepers will analyze the results of the actions taken by goalkeepers during training or during official games, in order to intervene with methodological solutions to optimize their training.

- The recorded data will serve as an argument to intervene operatively in the training plan for goalkeepers.

- Goalkeepers will be constantly informed about their actions during sports training or during official matches.

- Implementing the GPEXE software in the training process for goalkeepers will solve both the problem of increasing the quality of the game and improving their motor performance.

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1. **DINCĂ A., CIORBĂ C.** The content and game action weight of senior football players as goalkeeper. In: Bulletin of the Transilvania University of Brasov, Series IX: Sciences of Human Kinetics, vol. 17(66), no 2, 2024, p. 55-66. <https://doi.org/10.31926/but.shk.2024.17.66.2.6> (Erih Plus, DOAJ, EBSCO)
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ANNOTATION

Dinca Alin Răzvan *Goalkeeper training in football based on the application of the GPEXE software*: PhD thesis in Education Sciences. Chisinau, 2025

Structure of the Thesis: Introduction, 3 chapters, conclusions, references with 187 sources, 4 appendices, 127 pages of main text, 60 figures, 18 tables. The results obtained have been published in 6 scientific papers.

Keywords: football, seniors, playing position, goalkeeper, sports training, software, physical training, psychological training, training program.

Purpose of the Research to research the effectiveness of applying the GPEXE software in the training of senior football players in the goalkeeper position.

Research Objectives:

1. To analyze and summarize bibliographic data concerning the modernization of sports training at the senior level.
2. To systematize the game actions of senior football players in the goalkeeper position.
3. To assess the level of sports training of senior football players in the goalkeeper position.
4. To develop and implement an experimental sports training program for senior football goalkeepers using the GPEXE software.
5. To experimentally validate the effectiveness of implementing the experimental training program for senior goalkeepers based on the application of the GPEXE software.

Novelty and Originality of the Research consists in optimizing the sports training process for senior goalkeepers through the use of the GPEXE software. In this context, an experimental program was developed, accompanied by an implementation model featuring specific training tools tailored to the needs of senior football players, in this case, goalkeepers. This highlights the differentiated training of senior football players, with the given program being focused on the players training in the goalkeeper position.

Major Scientific Problem Addressed in the research addresses the need to optimize the differentiated training system for senior football players, with an emphasis on goalkeeper training. The role and importance of the goalkeeper are well-known in the football world, the goalkeeper often represents the last line of defense, but the outcome of both specific game actions and entire matches can depend significantly on their level of training.

Theoretical Significance of the study contributes by developing and implementing an experimental training program and pedagogical model for senior goalkeepers, utilizing the GPEXE software, a tool officially recognized by international football authorities. This implementation is aimed at enhancing the athletic performance of football players, particularly goalkeepers.

Practical Value of the Work. The research results can serve as methodological support for football coaches at specialized sports clubs, especially those focused on the specialized training of goalkeepers.

ADNOTARE

Dincă Alin Răzavn *Pregătirea portarilor în jocul de fotbal în baza aplicării softului GPEXE*:
Teză de doctor în științe ale educației. Chișinău, 2025

Structura tezei: Introducere, 3 capitole, concluzii, bibliografie 187 surse, 4 anexe, 127 pagini text de bază, 60 figuri, 18 tabele. Rezultatele obținute sunt publicate în 6 lucrări științifice.

Cuvinte-cheie: fotbal, seniori, post de joc, portar, antrenament sportiv, soft, pregătire fizică, pregătire psihologică, program de pregătire.

Scopul cercetării îl constituie cercetarea eficienței aplicării softului *GPEXE* în pregătirea fotbaliștilor seniori pe post de Portar.

Obiectivele cercetării:

1. Analiza și generalizarea datelor bibliografice privind modernizarea antrenamentului sportiv la nivel de seniori.
2. Sistematizarea acțiunilor de joc ale fotbaliștilor seniori pe postul de Portar.
3. Aprecierea nivelului pregătirii sportive a fotbaliștilor seniori pe postul de Portar.
4. Elaborarea și implementarea programului experimental de pregătire sportivă a fotbaliștilor seniori pe postul de Portar prin aplicarea softului *GPEXE*.
5. Validarea experimentală a eficienței implementării programului experimental de pregătire sportivă a fotbaliștilor seniori pe postul de Portar în baza aplicării softului *GPEXE*.

Noutatea și originalitatea cercetării constă în optimizarea procesului de pregătire sportivă a fotbaliștilor seniori pe postul de Portar în baza aplicării softului *GPEXE*. În acest sens a fost elaborat un program experimental însoțit de un model de implementare a acestuia cu seturi de mijloace specifice pregătirii fotbaliștilor seniori, în cazul dat, al fotbaliștilor pe postul de Portar. Acest lucru indică la pregătirea diferențiată a fotbaliștilor seniori, iar programul dat fiind axat pe pregătirea jucătorilor pe postul de Portar.

Problema științifică de importanță majoră soluționată în cercetarea dată rezidă în necesitatea optimizării sistemului de pregătire diferențiată a fotbaliștilor seniori, accentul fiind pus pe pregătirea sportivă a jucătorilor de pe postul de Portar. Rolul și importanța fotbaliștilor de pe postul de Portar este foarte bine cunoscut în lumea fotbalistică, acesta de fapt fiind ultima speranță a orice echipă aflată în defensivă, iar de nivelul pregătirii sportive a acestuia depinde foarte mult soarta unei acțiuni de joc sau a întregului meci.

Semnificația teoretică a studiului constă în elaborarea și implementarea în procesul de instruire a fotbaliștilor seniori pe postul de Portar a unui program experimental și a unui Model pedagogic prin folosirea softului *GPEXE*, acesta fiind unul aprobat de autoritățile competente în jocul de fotbal pe plan internațional. Implementarea acestui program vine să sporească performanța sportivă a fotbaliștilor, în mod special a fotbaliștilor pe postul de Portar.

Valoarea aplicativă a lucrării constă în faptul că rezultatele obținute în cercetare pot fi folosite în calitate de suport metodologic de către antrenorii de fotbal din cadrul cluburilor sportive specializate, care în mod special sunt specializați pe pregătirea specială a fotbaliștilor pe postul de Portar.

DINCĂ Alin Răzavn

**GOALKEEPER TRAINING IN FOOTBALL BASED ON THE
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