Improving the tactical preparedness of 3x3 basketball players based on the use of improvisational exercises

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Abstract

Background and purpose
Purpose. To improve the tactical interaction of players in 3x3 basketball at the stage of specialized basic training based on the use of specific improvisational exercises, taking into account the specifics of the players’ competitive activity.

Material and methods
Two groups of basketball players at the stage of specialized basic training, 12 athletes each, took part in the research, taking into account the lack of reliability of differences in the analysed indicators at the beginning of the study (р > 0.05). All participants gave an informed consent to partake in this experiment. Descriptive statistics (arithmetic means in groups (M), mean square deviations (SD), errors of arithmetic means (m)) were calculated for each dependent variable. The Student’s t-test was used to estimate the probability of differences in one feature before and after the experiment, provided that the data had a normal distribution. The Wilcoxon Signed Ranks Test (Z test) was used in case of non-compliance with the normal distribution of the data of two dependent samples. The Mann-Whitney U-test was used to compare the differences between the results of two independent samples in different tests.

Results
The analysis of the dynamics of changes in the teams’ game performance (the changes were revealed in the process of analysing video recordings of games in 3x3 format competition) showed that the experimental group players increased the number of attacks per game to 20.20 ± 2.59 and improved their performance to 12.00 ± 2.45, which was 59.05% of efficiency. Indicators in control group remained almost unchanged, and the efficiency equalled 50.25%. The comparison of changes in all indicators in the groups after the experiment still has no statistical difference (the number of attacks - t = 0.819 at р = 0.444; of them effective - t = 1.671 at р = 0.146; in terms of effectiveness - t = 1.632 at р = 0.154).

Conclusions
Our proposed option for improving the tactical interactions of 3x3 basketball players, which was based on the use of specific improvisational exercises for 12 weeks’ period, had a positive effect on basketball players’ tactical preparedness, increasing the effectiveness of their game performance during competitive games.

Keywords: 3x3 basketball, tactics, interactions, game performance, competitive activity, improvement
Анотація

Мусіенко А.В., Цимбалаюк Ж.О., Несен О.О., Фадлі Іхсан, Еді Сетіаван. Вдосконалення тактичної підготовленості баскетболістів 3х3 на основі використання імпровізаційних вправ

Обґрунтування і мета

Мета. Вдосконалив тактичні взаємодії гравців у баскетболі 3х3 на етапі спеціалізованої базової підготовки на базі використання специфічних імпровізаційних вправ, враховуючи особливості змагальної діяльності гравців.

Матеріал і методи

У дослідженні взяли участь дві групи баскетболістів на етапі спеціалізованої базової підготовки по 12 спортсменів в кожній, з урахуванням відсутності достовірності відмінностей у показниках, що вивчалися на момент початку дослідження (p>0,05). У всіх учасників було отримано інформовану згоду на участь в цьому експерименті. Описова статистика (середні арифметичні в групах (М), середні квадратичні відхилення (SD), помилки середніх арифметичних (m)) була розрахована для кожної залежної змінної. За t-критерієм Стьюдента оцінювалась вірогідність розходження за одною ознакою до і після експерименту за умови відповідності нормальному розподілу даних. Тест знакових рангів Вілкоксона (Z-критерій) (Wilcoxon Signed Ranks Test) застосовувався у випадку невідповідності нормальному розподілу даних двох залежних вибірок. Для порівняльного аналізу відмінностей між результатами двох незалежних вибірок у різних тестах використовували U-критерії Манна-Уїтні.

Результати

Аналіз динаміки змін ігрових показників команд, визначених в результаті аналізу відеозапису ігор змагань у форматі 3х3, виявив, що гравці ЕГ збільшили кількість атак за гру до 20,20±2,59, при цьому покращили їх результативність до 12,00±2,45, що склало 59,05% ефективності. Показники в ЕГ залежали майже незмінні, а ефективність дорівнює 50,25%. Порівняння змін за всіма показниками в групах після експерименту все ж таки не має статистичної різниці (кількість атак − t = 0,819 при р = 0,444; з них результативних − t = 1,671 при р = 0,146; за ефективністю − t = 1,632 при р = 0,154).

Висновки

Запропонований нами варіант вдосконалення тактичних взаємодій гравців у баскетболі 3х3, яких базувався на використанні специфічних імпровізаційних вправ, підтвердив ефективність іх громадських показників під час змагальних ігор.

Ключові слова: баскетбол 3х3, тактика, взаємодії, ігрові показники, змагальна діяльність, вдосконалення

Анотация

Мусиенко А.В., Цимбалюк Ж.А., Несен Е.А., Фадли Ихсан, Эди Сетиаван. Совершенствование тактической подготовленности баскетболистов 3х3 на основе использования импровизационных упражнений

Обоснование и цель

Цель. Совершенствовать тактическое взаимодействие игроков в баскетболе 3х3 на этапе специализированной базовой подготовки на основе использования специфических импровизационных упражнений, учитывая особенности соревновательной деятельности игроков.

Материал и методы

В исследовании приняли участие две группы баскетболистов на этапе специализированной базовой подготовки по 12 спортсменов в каждой, с учетом отсутствия достоверности различий в показателях, изучавшихся на момент начала исследования (p>0,05). Во всех участниках было получено информированное согласие на участие в этом эксперименте. Описательная статистика (средние арифметические в группах (М), средние квадратические отклонения (SD), ошибки средних арифметических (m)) рассчитана для каждой зависимой переменной. По t-критерию Стьюдента оценивалась вероятность различий по одному признаку до и после эксперимента при соответствиях нормальному распределению данных. Тест знаковых рангов Вилкоксона (Z-критерий) (Wilcoxon Signed Ranks Test) применялся при несоответствии нормальному распределению данных двух зависимых выборок. Для сравнительного анализа различий между результатами двух независимых выборок в разных тестах использовали U-критерий Манна-Уитни.

Результаты

Анализ динамики изменений игровых показателей команд, определенных в результате анализа видеозаписи игр соревнований в формате 3х3, определил, что игроки экспериментальной группы увеличили количество атак за игру до 20,20±2,59, при этом улучшили их результативность до 12,00±2,45, что составило 59,05% эффективности. Показатели в контрольной группе остались почти неизменными, а эффективность равна 50,25%. Сравнение изменений по всем показателям в группах после эксперимента все же не имеет статистической разницы (количество атак – t = 0,819 при p = 0,444; из них результативных – t = 1,671 при p = 0,146; по эффективности – t = 1,635 при p = 0,154).

Выводы

Предложенный нами вариант совершенствования тактических взаимодействий игроков в баскетболе 3х3, основанных на использовании специфических упражнений импровизационного характера на протяжении 12 недель положительно повлиял на тактическую подготовленность баскетболистов, повысив эффективность их игровых показателей во времена соревновательных игр.

Ключевые слова: баскетбол 3х3, тактика, взаимодействие, игровые показатели, соревновательная деятельность, совершенствование
Introduction

The need for scientific substantiation of technical and tactical issues while training players in 3x3 basketball has recently gained relevance. Thus, Dimitrije Cabarkapa and co-authors [1] in their work emphasize the insufficient number of scientific works on the study of game activity features and physical training of players in 3x3 basketball. Paul G Montgomery and Brendan D Maloney [2], Mykola Bezmilov, Wenpeng Cui [3] note that although basketball and 3x3 basketball look similar, there are certain differences in athletes’ physiological and psychological abilities. The authors emphasize that for the effective development of 3x3 basketball, it is necessary to study it in depth as a different sport – its game characteristics, requirements for various aspects of players’ preparation, etc [4-6]. A number of authors emphasize on the existence of differences between 3x3 basketball and its classic version [7-9]. They emphasize that the smaller number of team players increases the demands to the athletes’ functional capabilities as they have to perform active actions and take countermeasures more often on the playing field [8-11]. Mauro Sánchez Sánchez [12] in his work emphasizes that performance in basketball should be understood as an interaction of many factors, among which group cohesion (psychosocial factor) [13] and the degree of technical and tactical adaptation of players [10-15] are of particular interest.

Studying the specificity of 3x3 basketball players’ training cycles [4, 16], the scientists noticed that the basketball players’ training process lasts for the whole year, in contrast to the training cycles of 3x3 basketball players in Ukraine. In the FIBA methodological manual [http://surl.li/rwzzpz], a detailed approach to planning the training of 3x3 basketball players, suggests considering two options: when players participate in classic 5x5 basketball games and in 3x3 games, and when players specialize only in 3x3 games.

A number of authors [17-20] reveal options for training 3x3 basketball teams. The authors also emphasize the differences between the classic and the 3x3 game variant [21-24], focusing on the need for scientifically based recommendations regarding the process of organizing and preparing teams for participation in competitions [25-27]. Summarizing the above mentioned, it is possible to state the relevance of the research topic and the need to improve 3x3 basketball players’ tactical preparation.

The purpose of the study is to improve the tactical interactions of 3x3 basketball players at the stage of specialized basic training using specific improvisational exercises and taking into account the specifics of qualified players’ competitive activity.

Material and methods

Participants

Two groups of basketball players at the stage of specialized basic training, 12 athletes each, took part in the study, taking into account the lack of reliability of differences in the indicators studied at the time of the beginning of the study (p>0.05). Informed consent was obtained from all participants to participate in this experiment.

Ethical policy

This research included humans and therefore has been provided in according to principles embodied in the Helsinki Declaration. The studies were approved by the Ethics Committee of H. S. Skovoroda Kharkiv National Pedagogical University.

Procedure

After receiving the initial indicators of the effectiveness of tactical interactions of basketball players aged 15-16 [26, 27], sets of exercises were selected and a plan for their use in the educational and training process of athletes of the experimental group was drawn up [21, 22, 24, 25].

The training process of the basketball players of the control group met the requirements of the basketball training programs of the State University of Secondary Education according to the generally accepted method of training classical players, but the training took place on open courts with the use of appropriate equipment. The athletes of the experimental group used specialized 3x3 basketball exercises in their training according to a special program, in which additional time was devoted to studying and improving the tactical interactions of athletes on the court by means of controlled-improvised exercises. The experiment lasted 12 weeks, after which a re-analysis of the sportsmen’s gaming activity was carried out in terms of the use of tactical interactions.

Comparison of training programs for basketball players is shown in Table 1.
A sample of the content of the program for the training of basketball players

<table>
<thead>
<tr>
<th>Athletes of the control group</th>
<th>Athletes of the experimental group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Psychological preparation</strong></td>
<td></td>
</tr>
<tr>
<td>Development of willpower,</td>
<td>Development of emotional intelligence, psychological stability, leadership</td>
</tr>
<tr>
<td>psychological stability during training sessions</td>
<td>both in training sessions during physical exercises and tasks, and in additional sessions after training</td>
</tr>
<tr>
<td><strong>Technical and tactical training</strong></td>
<td></td>
</tr>
<tr>
<td>Fundamental skills of 3x3 basketball through structured drills and practices, focusing on mastering the fundamentals</td>
<td>Understanding the differences between 5x5 and 3x3 interactions. Mastering the algorithm of actions in the most common interactions in 3x3 basketball and developing the ability to make variations and improvisations in the selection of interactions, taking into account the rapid changes in game situations in the game</td>
</tr>
<tr>
<td><strong>Game preparation</strong></td>
<td></td>
</tr>
<tr>
<td>A regular schedule of competitive games, leagues and tournaments, giving players the opportunity to apply their acquired skills in a competitive environment</td>
<td>Balanced and competitive game schedule including league games, tournaments and friendlies with different models such as round robin and skill competitions</td>
</tr>
</tbody>
</table>

We have developed game training exercises for learning and improving tactical interactions in the attack in 3x3 basketball. They were based on the use of types of screens and had several options for choosing tactical interactions in their solution. The purpose of their application is the formation of a generalized indicative basis for typical group tactical interactions, the combination of improving group tactical actions and interactions in attack and defense at the same time. By regulating the actions of the defenders, it is possible to complicate game situations, increase their number and the possibility of using a wider spectrum and options of interactions.

Training exercises are created in the Basketball Playbook software package and presented schematically on an animated screen that allows you to create game sequences and monitor the progress of their playback (Fig. 1-3).

![Fig. 1. Sequence of actions in Back screen 1 combination](image-url)

Notes:

- the direction of the player's movements
- the direction of the ball transfer
- players
- ball
- throw the ball into the basket
- player movement and screen
The effectiveness of tactical interactions was recorded during the video review and analysis of the athletes' competitive games by three trained observers, as well as the analysis of the protocols of these games. Quantitative and qualitative indicators of technical and tactical actions related to the game were established. The total and effective number of attacks, their percentages, interceptions, losses, performance indicators, etc., tactical individual actions and interactions (group (for two players) and team (for three players)) were calculated.

Group (for two players) and team (for three players) tactical interactions were registered, namely: attacking the ring through the center, passing to the perimeter after a pick-up - quick return pass, two-player interactions (targeting, screens) and team play using screens behind involving three players.

During the formative experiment, 19 games of the two teams that took part in the experiment were analyzed. They are posted on the YouTube channel and the official FBU website for 2023. These are the games of city and All-Ukrainian competitions in 3x3 basketball in the age category U-16 (cadets).

**Statistical analysis**

The research results were processed using the Statistica package. Compliance of the obtained data with the law of normal distribution was checked using the Shapiro-Wilk W-criterion of consistency.

Descriptive statistics (arithmetic means in groups (M), mean square deviations (SD), errors
of arithmetic means (m)) were calculated for each dependent variable. The Wilcoxon Signed Ranks Test (Z test) was used in case of non-compliance with the normal distribution of the data of two dependent samples. The Mann-Whitney U-test was used to compare the differences between the results of two independent samples in different tests.

**Results**

After the experiment, the game indicators of the teams of 15-16-year-old players were re-determined based on the competition protocols and video recordings of the games. The repeated analysis revealed a number of positive changes that occurred under the influence of the program developed by us.

The dynamics of changes in the indicators of competitive activity of experimental group (n=4) and control group (n=4), determined as a result of the analysis of competition protocols in the 3x3 format

<table>
<thead>
<tr>
<th>Indicators (unit of measurement)</th>
<th>Research period</th>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>TE and AE</th>
<th>Function of differences, level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points per game (number)</td>
<td>BE</td>
<td>CG</td>
<td>13.00</td>
<td>2.00</td>
<td>Z = -0.535</td>
<td>p = 0.593</td>
</tr>
<tr>
<td></td>
<td>AE</td>
<td></td>
<td>10.30</td>
<td>5.86</td>
<td>Z = -0.272</td>
<td>p = 0.785</td>
</tr>
<tr>
<td></td>
<td>BE</td>
<td>EG</td>
<td>12.83</td>
<td>1.94</td>
<td>Z = -1.069</td>
<td>p = 0.285</td>
</tr>
<tr>
<td></td>
<td>AE</td>
<td></td>
<td>13.20</td>
<td>1.92</td>
<td>Z = 0.000</td>
<td>p = 1.000</td>
</tr>
<tr>
<td>Points conceded per game (number)</td>
<td>BE</td>
<td>CG</td>
<td>10.00</td>
<td>2.74</td>
<td>Z = -1.109</td>
<td>p = 0.383</td>
</tr>
<tr>
<td></td>
<td>AE</td>
<td></td>
<td>12.00</td>
<td>6.93</td>
<td>t = -0.462</td>
<td>p = 0.660</td>
</tr>
<tr>
<td></td>
<td>BE</td>
<td>EG</td>
<td>10.17</td>
<td>3.54</td>
<td>Z = 1.534</td>
<td>p = 0.05</td>
</tr>
<tr>
<td></td>
<td>AE</td>
<td></td>
<td>10.00</td>
<td>5.95</td>
<td>Z = 1.000</td>
<td>p = 1.000</td>
</tr>
<tr>
<td>Fouls (number)</td>
<td>BE</td>
<td>CG</td>
<td>6.40</td>
<td>2.07</td>
<td>t = -1.109</td>
<td>p = 0.383</td>
</tr>
<tr>
<td></td>
<td>AE</td>
<td></td>
<td>6.33</td>
<td>3.06</td>
<td>t = 0.625</td>
<td>p = 0.660</td>
</tr>
<tr>
<td></td>
<td>BE</td>
<td>EG</td>
<td>6.33</td>
<td>1.21</td>
<td>t = 0.825</td>
<td>p = 0.456</td>
</tr>
<tr>
<td></td>
<td>AE</td>
<td></td>
<td>5.40</td>
<td>2.61</td>
<td>t = 0.625</td>
<td>p = 0.660</td>
</tr>
<tr>
<td>Losses (quantity)</td>
<td>BE</td>
<td>CG</td>
<td>6.80</td>
<td>1.79</td>
<td>t = -0.500</td>
<td>p = 0.667</td>
</tr>
<tr>
<td></td>
<td>AE</td>
<td></td>
<td>7.00</td>
<td>2.00</td>
<td>t = 0.625</td>
<td>p = 0.660</td>
</tr>
<tr>
<td></td>
<td>BE</td>
<td>EG</td>
<td>6.50</td>
<td>1.87</td>
<td>t = 1.534</td>
<td>p = 0.200</td>
</tr>
<tr>
<td></td>
<td>AE</td>
<td></td>
<td>4.20</td>
<td>1.30</td>
<td>t = 0.625</td>
<td>p = 0.660</td>
</tr>
</tbody>
</table>

Notes: EG - experimental group, CG - control group, AE - after the experiment, BE - at the beginning of the experiment

So, on average, control group players scored less points per game (10.30±5.86). In experimental group players, the indicator improved (13.20±1.92). But the dynamics of changes in each of the groups does not have a significant difference, and the comparison of indicators in the groups after the experiment also did not determine a statistical difference. However, the small value of the standard deviation (SD = 1.92) in experimental group indicates more stable performance from game to game of the team.

The average number of points conceded per game increased in control group (12.00±6.93), and experimental group began to concede less (10.00±5.95). But the intragroup dynamics again have no significant difference, the indicators between the groups after the experiment are also without statistical difference. In both groups, the standard deviation is high (6.93 and 5.95, respectively), which indicates unstable actions and interactions in defense in both teams and needs further improvement.

There is a tendency to decrease the average indicator of the number of fouls per game in experimental group to 5.40±2.61 and almost unchanged indicators in control group 6.33±3.06.
But these changes have no statistical difference between the groups after the experiment and need further improvement of the defensive game.

However, the number of losses per game significantly decreased in experimental group to 4.20±1.30, which has a statistical difference (t = -2.441 at p = 0.05) with control group indicators (7.00±2.00). Usually, researchers associate the number of losses in a team game with a low game understanding of the players on the court, incoherence of team interactions. The use of tactical training exercises in the experimental group training process had a positive effect on this indicator.

The analysis of the dynamics of changes in the team's game indicators, determined as a result of the analysis of the video recordings of the games of the competition in the 3x3 format (Table 3), determined that the experimental group players increased the number of attacks per game to 20.20±2.59, while improving their performance to 12.00 ±2.45, which was 59.05% efficiency. Moreover, when assessing the practical significance of the dynamics of the indicator "Number of effective attacks per game" in experimental group, the calculated value of the statistical effect is large (dz = 0.894). Indicators in control group remained almost unchanged, and the efficiency is equal to 50.25%. Comparison of changes in all indicators in the groups after the experiment still has no statistical difference (the number of attacks - t = 0.819 at p = 0.444; of them effective - t = 1.671 at p = 0.146; by efficiency - t = 1.632 at p = 0.154).

Comparing the ratio of changes in indicators after the experiment between the number of individual actions and the number of group interactions in the attack, a tendency to change the experimental group game style to a team one was determined. Thus, insignificantly reduced the number of individual actions in the attack per game (9.2±1.3), experimental group improved their performance indicator to 6.2±1.3, which was 67.60% of implementation efficiency.

Table 3
The dynamics of changes in game indicators of experimental group (n=4) and control group (n=4), determined as a result of the analysis of video recordings of competition games in the 3x3 format
### Efficiency of individual actions in the attack (%)

<table>
<thead>
<tr>
<th>Group</th>
<th>EG</th>
<th>CG</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>51.64</td>
<td>45.64</td>
<td>-1.251</td>
<td>0.279</td>
</tr>
<tr>
<td>AE</td>
<td>67.60</td>
<td>51.49</td>
<td>-0.747</td>
<td>0.533</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>EG</th>
<th>CG</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>19.13</td>
<td>9.34</td>
<td>2.446</td>
<td>0.050</td>
</tr>
<tr>
<td>AE</td>
<td>9.94</td>
<td>6.23</td>
<td>5.033</td>
<td>0.050</td>
</tr>
</tbody>
</table>

### Number of group interactions in attack (number)

<table>
<thead>
<tr>
<th>Group</th>
<th>EG</th>
<th>CG</th>
<th>U</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>8.17</td>
<td>5.00</td>
<td>0.00</td>
<td>0.008</td>
</tr>
<tr>
<td>AE</td>
<td>11.00</td>
<td>2.12</td>
<td>0.00</td>
<td>0.102</td>
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</tbody>
</table>

<table>
<thead>
<tr>
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<th>CG</th>
<th>Z</th>
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<tbody>
<tr>
<td>BE</td>
<td>0.98</td>
<td>1.41</td>
<td>-2.207</td>
<td>0.027</td>
</tr>
<tr>
<td>AE</td>
<td>1.41</td>
<td>1.41</td>
<td>0.027</td>
<td>0.027</td>
</tr>
</tbody>
</table>

### The number of productive group interactions in the attack (number)

<table>
<thead>
<tr>
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<th>U</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
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<td>4.20</td>
<td>0.5</td>
<td>0.026</td>
</tr>
<tr>
<td>AE</td>
<td>1.41</td>
<td>1.10</td>
<td>0.026</td>
<td>0.026</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>EG</th>
<th>CG</th>
<th>Z</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>BE</td>
<td>1.41</td>
<td>0.58</td>
<td>-2.232</td>
<td>0.026</td>
</tr>
<tr>
<td>AE</td>
<td>1.47</td>
<td>0.58</td>
<td>0.026</td>
<td>0.026</td>
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</tbody>
</table>

### Effectiveness of group interactions in attack (%)

<table>
<thead>
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<th>p</th>
</tr>
</thead>
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<tr>
<td>BE</td>
<td>48.02</td>
<td>54.43</td>
<td>6.5</td>
<td>0.763</td>
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<tr>
<td>AE</td>
<td>12.86</td>
<td>14.82</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>EG</th>
<th>CG</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>12.86</td>
<td>14.82</td>
<td>-1.53</td>
<td>0.249</td>
</tr>
<tr>
<td>AE</td>
<td>10.75</td>
<td>14.82</td>
<td>0.249</td>
<td>0.249</td>
</tr>
</tbody>
</table>

### Notes:

- EG - experimental group, CG - control group, AE - after the experiment, BE - at the beginning of the experiment.
- Z and t values are the results of statistical tests.
- Control group statistically significantly (t = -7.00 at p = 0.020) increased the number of individual actions in the attack to 13.67±2.08, which indicates the superiority of the individual style of attack, and the assessment of the practical significance of the dynamics of this indicator based on the calculated value of the statistical effect is average (dz = 0.58).
- At the same time, the efficiency index of individual actions improved significantly in this group to 7.00±0.87 (the statistical effect is high (dz = 1.154)), but the efficiency index was only 51.49%. When evaluating the practical significance of the dynamics of the indicator "Number of individual actions in the attack" between control group and experimental group after the experiment, the calculated value of the statistical effect is large (dz = 1.61). Comparison of changes in the effectiveness of individual actions in the attack in both groups after the experiment still have more significant changes in experimental group (t = 2.446 at p = 0.05).

- Nevertheless, experimental group statistically significantly (Z = -2.207 at p = 0.027) increased the number of group interactions in the attack to 11.00±1.41 with a statistically significant (Z = -2.232 at p = 0.026) increase in their implementation to 5.80 ±1.47, which improved the efficiency index to 52.01%. In control group, the number of group interactions in the attack decreased on average to 5.00 with the implementation of 2.25±0.58 (changes in both indicators are random), which resulted in a decrease in the effectiveness of group interactions to 46.67%. But when comparing changes in performance indicators after the experiment in both groups, no significant difference was determined (U = 6.5 at p = 0.763).

- The obtained data indicate a positive effect on the effectiveness of team activities, improvement of the effectiveness of game indicators of such factors as: the advantage of the team style of play, the indicator of the effectiveness of actions in the attack. According to the results of the pedagogical observation of the game activity of the players at the 3x3 competitions, the coordination and game mutual understanding of the players improved during the competitions (especially in the experimental group) due to the establishment of game communication. The variety of tactical interactions between the players of the experimental group increased compared to the control group. Players acted more confidently when choosing a course of action in game situations, which were understood in training exercises. The positive impact of the application of the developed program on the manifestations of game intelligence of the players is indicated.

### Discussion

The study confirmed the hypothesis about the effectiveness of using specific improvisational exercises to improve tactical understanding during the competitive activity of a 3x3 basketball team. The use of a structured approach in the educational and
training process contributed to the formation of team cohesion, collective efficiency, the development of technical and tactical skills, and productivity during the competitive activity of the 3x3 basketball team.

The effectiveness of specific improvisational exercises was also confirmed by improving most competitive indicators. This is due to the fact that we have identified those areas of tactical training that made it possible to improve the effectiveness of the competitive activity of the 3x3 team, which is an indicator of the teamwork coherence. Thus, at the beginning of the preparation for the competition, training exercises were used to develop specific skills in 3x3 basketball, which later became the basis for improving the players’ tactical interactions. Their list coincides with the data of methodological recommendations on training 3×3 players [19, 20, 21]. Later, game situations were used, which required tactical interaction of 2 or 3 players in 3×3; it corresponds to modern trends and the latest publications on game tactics [6, 9, 24]. Special attention is paid to tactical interactions in the attack in 3×3 basketball, basing on the use of different types of screens, because a number of studies have proved the quantitative advantage of these interactions in the game of the world’s leading teams and the feasibility of screens use in 3×3 basketball [25]. Training exercises for learning and improving the types of screens have the most common game sequences described in professional methodological works [15, 26], which expands the player’s choice of combinations.

The result of using improvisational exercises was a significant improvement of most competitive indicators of the experimental group. The experimental group players scored more points per game on average compared to the control group. Although this difference is not statistically significant, the experimental group showed more stable performance from game to game. These players conceded fewer points per game on average compared to the control group though the difference was also not statistically significant. A high standard deviation in both groups indicates instability in the defense and the need for further improvement.

Players in the experimental group tended to have fewer fouls and turnovers per game, which may indicate improvements in defensive play and team coordination. The reduction in losses in the experimental group is statistically significant (t = -2.441 at p = 0.05), which indicates an improvement in players’ mutual understanding and in team interactions and may be explained by the use of tactical training exercises.

The improvement of tactical interactions formed the players’ patterned motor experience during multiple repetition of combinations [5, 15], and due to their combination and transfer to new unfamiliar game situations it developed the ability to the expedient choice of already known ways of performing tactical actions (interactions) and taking the initiative [5, 9, 16]. As a result, the number of attacks per game increased significantly and their effectiveness also improved significantly (t = 6.5 at p = 0.003); however, the advantage in the effectiveness of this indicator between the groups was not statistically significant (59.05% vs. 50.25%).

It should be noted that the traditional method of learning and improving tactical actions (interactions), which is usually used in sports games [23, 24], has been supplemented by some innovative approaches and information technologies [14, 17]. We have developed a program that helped to form a correct idea of interaction among players via the use of visual polygraphic and electronic diagrams, manuals, video clips at the stage of familiarization with game situations, general schemes of interactions and methods of their implementation.

The players of the experimental group reduced the number of individual actions in the attack and increased the number of group interactions. This indicates the superiority of the team style of play and the improvement of the effectiveness of group interactions, the effectiveness of the implementation of individual actions in the attack has significantly increased (t = 2.446 at p = 0.05); the number of group interactions in the attack has significantly increased and their effectiveness has significantly improved, which indicates a tendency to change the style of play to a team one. However, the standard deviation (SD) values for these metrics were relatively small, indicating more consistent results from game to game.

In the experimental group, the number of losses per game significantly decreased, which indicates an improvement in the players’ mutual understanding and the coherence of team interactions.

As a result, the obtained data testify to the positive influence of the pedagogical experiment on various aspects of the game of teams in the 3×3 basketball format. What is important is the tendency towards a team style of playing and improving the
efficiency of the offensive actions, which can be important to achieve success in this game format.

Overall, the implemented developed program had a positive effect on the competitive performance of the experimental group, which demonstrated significant improvement in several key areas. However, this team still has some room for improvement, as their overall performance is still below the world requirements for players of this age [6, 7, 9, 10].

The conducted research is an experimental confirmation and practical implementation of scientific sports views on the process of learning tactical interactions [4, 5, 21].

**Conclusions**

Our proposed option for improving the tactical interactions of 3x3 basketball players, which was based on the use of specific improvisational exercises for 12 weeks' period, had a positive effect on the basketball players' tactical preparedness, increasing the effectiveness of their game performance during competitive games. The effectiveness of visualization methods in model game strategies in the training process of the experimental group was determined. There is an increase in the number of points scored per game in the experimental group (up to 13.2±1.92) and a decrease in the number of fouls (up to 5.4±2.61) and losses (4.2±1.3), but the changes are not significant (p > 0.05). However, the number of group interactions in the attack in the experimental group after the formative experiment prevails over individual actions (11±1.41 vs. 9.2±1.3 on average per game) and their effectiveness has a statistical improvement (Z = -2.232 at p = 0.026). Comparison of the quantity and effectiveness of group interactions after the experiment between the groups determined statistically significant differences in favor of the experimental group (U = 0.00 at p = 0.008; U = 0.5 at p = 0.026, respectively). What, in our opinion, affected the performance of the experimental group at the All-Ukrainian 3x3 basketball competition (1st place).

**Conflict of interest**

The authors declare that there is no conflict of interest.

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