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FENCING TRAINING EFFECT ON CHILDREN DIAGNOSED WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER

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Abstract. The present article relates the impact of a Fencing Training program applied to a population diagnosed with Attention Deficit Hyperactivity Disorder (ADHD), as a therapeutic model for reducing the abnormal symptoms of this disorder. The correlation between physical activity (PA) and the benefits of mitigating ADHD symptoms is a common fact, while the added value of warrior skills reflected by Martial Arts such as Fencing on various areas of personality domains is a relative new terrain of research in the literature. The study (based on Czuckermann, 2016) was carried out for 9 months (90 min biweekly sessions) and included two groups (n = 20, 10 boys and 10 girls each) with a mean age of 10 at the beginning of the study. The experimental ADHD group was termed Fencing Training Experimental Group (FTEG); the control group was termed Physical Activity Control Group (PACG). The Inattention data, as reflected by the ADHD RS IV Questionnaire, indicate that the value difference between the preliminary stage and the final stage of the FTEG (193) is much greater than that of the PACG (52). As for the Hyperactivity/Impulsivity characteristic, the FTEG difference (180) is slightly greater than that of the PACG (162). The Fencing Training program was found to have higher impact on all ADHD characteristics, as reflected by the ADHD Rating Scale IV Questionnaire, supporting the presumption of superiority of the Fencing Training program over the plain PA program regarding the mitigation of ADHD symptoms.

Keywords: fencing, ADHD, physical activity.

Introduction

This article presents the effect of fencing training and physical activity (PA) programs on the ADHD diagnosed population, as reflected by the ADHD RS (Rating Scale) IV Home Edition Questionnaire (DuPaul et al., 1998). ADHD, as it is known today, is a neurobehavioral disorder defined by the American Psychiatric Association (2013) as “a neurodevelopmental disorder defined by impairing levels of inattention, disorganization, and/or hyperactivity-impulsivity”. Given that it is neither a new viral disease as the Human Immunodeficiency Virus (HIV) that has emerged only recently, nor is a new side effect of the latest technological development as the Computer Vision Syndrome, it can be said that ADHD is one of the latest fashionable disorder of the society. Actually, ADHD has existed since the beginning of human evolution and, during our history, we lived with it without ever being aware of its existence and the influence it might have on our careers. Since the first disclosure of the phenomena, back in 1836, with the nursery rhyme “Fidgety Phil” by Hoffmann (1848) in his book Struwwelpeter, society has adopted the argument that “the history is written by the winners – the winners take it all” by putting aside theories seeing in ADHD other than a disorder, for instance:

- Hartmann’s Hunter vs. Farmer Theory (1993) raising the challenging question: “Is ADHD really a disorder or just a group of wonderful gifts inherited from the hunter – well-suited to a simple way of life but often incompatible with the more complex society in which we find ourselves?”
- Armstrong’s Neurodiversity Theory (2010) stating that ADHD is no more than a diverse neurological condition appearing as a result of normal variations in the human genome. Moreover, the subjects have full legalisation to live their lives as they are in the authentic forms of human diversity and self-expression.
- Social Construct Theory, supported by Szasz (1961), who has argued that ADHD is “invented and not discovered” and is not necessarily an actual pathology, but a socially constructed explanation to describe behaviours that simply do not meet prescribed social norms.

More recently, Saul (2014) has made a bridge between Neurodiversity and Social Construct stating that “ADHD is not a condition on its own, but rather a symptom complex caused by over twenty separate conditions – from poor eyesight and giftedness to bipolar disorder and depression – each requiring its own specific treatment”.

The influence of PA on ADHD has been comprehensively investigated during the last years under numerous aspects; PA shows promise for addressing ADHD symptoms in young children (Smith et al., 2013); Kiluk, Weden and Culotta (2009) have observed that practicing PA promotes emotional functioning; Gapin, Labban and Etnier (2011) and Berger et al. (2014) report that PA reduces the risk for ADHD symptoms; functional adaptation of children with ADHD can be clinically relevant with a structured PA program (Verret et al., 2012); reduced impairment associated with ADHD following moderate-to-vigorous pre-school PA intervention relative to a sedentary classroom-based intervention (Hoza et al., 2015); Wigal et al. (2012) notice that psycho-stimulants,
which are catecholamine agonists, can treat the dopaminergic and noradrenergic core symptoms of ADHD similarly to PA.

Matthew et al. (2013) have concluded that single bouts of 20 minutes mild aerobic exercise produce positive effects on children with ADHD, and recently, Benzing, Chang and Schmidt (2018) replicated this conclusion with 15-minute bouts of moderate-intensity PA, while Suarez-Manzano et al. (2018) supported the findings with a systematic review of intervention studies. Bout duration was reduced by Gawrilow et al. (2016), which improved executive functioning after only 5 min of vigorous activity, and Egmond-Frohlich et al. (2012) reported positive correlation with PA combined with good nutrition.

Redman (2007) associated dance/movement therapy to improved ADHD behaviour, and later, Chien-Yu et al. (2017) determined that a horse-riding program combined with fitness training influenced the motor proficiency and physical fitness of children with ADHD similarly to the effect of tennis exercise investigated by a co-worker team (Chien-Yu et al., 2019); Zi iterative and Jansen (2014) have concluded, from two experimental and one control groups, that long-term PA has a positive effect on executive functions of children with ADHD, regardless of the PA specificity.

The benefits of practicing Martial Arts were previously outlined as improving the emotional state (Capulis, Dombrovskis, & Guseva, 2014), helping children and their caregivers deal with ADHD issues without resort to aggressive and possibly harmful drug therapies (Ripley, 2003), while Reishehe Reishehe and Suleiman (2013) showed that there was a significant relationship between confidence and educational confidence in Martial Arts.

Fencing is a combat-oriented PA using dexterity to the advantage of a warrior, such as accuracy, physical condition, strength, speed, cardiovascular endurance, agility, flexibility, muscular endurance, response time, eye-hand and eye-hand-leg coordination, self-control and mental abilities, high concentration and attention, caution and patience. A fencer must make a decision on “when and how to apply a given action” (Czajkowski, 2009a), as the “selection of the right stroke is probably the most basic tactical ability of a fencer” (Czajkowski, 2009b). Johnson and Rosen (2000) outlined various benefits of fencing, such as improving physical conditioning and emotional balance, and a pilot study by Garcia (2016) determined the impact of a fencing training program on reducing the frequency of ADHD behavioural symptoms. Fencing requires courage, as defined by Ion-Ene, Roșu and Neofit (2013) with regard to Judo: a means developing one’s will, self-confidence, calm, ability to think and anticipate, ability to effectively solve the combat situations, i.e., a complex of psychological qualities useful in daily life.

Material and methods

Participants

The research population (N = 40) included the FTEG of 20 ADHD children (10 boys and 10 girls, mean age of 10 at the beginning of the study) performing a fencing activity program and the PACG consisting of another similar sample of 20 participants performing a PE program.

Instruments

For statistical homogeneity, as explored by Goodman et al. (2010), all children were ADHD diagnosed at the beginning of the research using the ADHD RS IV: Home Version Questionnaire, found to be easy and handy to scale and evaluate (Zhang et al., 2005). The ADHD RS IV Questionnaire is a set of eighteen questions regarding a child’s behaviour, conceived by DuPaul et al. (1998) and used to aid in the diagnosis of ADHD in children ranging from ages 5-17. The result of each question is marked with a number between 0 (Never or Rarely) and 3 (Very/Often) indicating the frequency of the behaviour.

Procedure

The period of the research was a consecutive academic year (9 months), with the intensity of 90 min twice a week for both groups. The research population was divided randomly and had no previous expertise in fencing, similarly to the research conducted by Kang et al. (2011) with 13 diagnosed ADHD children undergoing sport activity compared to a control group of 15 diagnosed ADHD children performing education on behaviour control sessions during a 6-week experiment conducted for 90 min twice a week. The study was performed within an after-school activity program with a population chosen among Misgav elementary school and fencing clubs in Akko city, Kiryat Ata city and Maalot city. The study complied with the WMA Declaration of Helsinki, having the parents’ agreement.

The group undergoing the fencing training program comprised three steps throughout the annual program:
• Step A: November 2015 - January 2016 – basic fencing skills and improvement of physical condition;
• Step B: February 2016 - May 2016 – tactical fencing skills and improvement of fencing-specific physical condition;
• Step C: June 2016 - October 2016 – competitive fencing skills including internal and regional club competitions.

The PACG was engaged in physical education (PE) lessons using the same amount of time and intensity as the study group, but their activity was focused on general physical fitness.

At the end of the research, both training and control groups were once again evaluated using the ADHD RS IV: Home Version Questionnaire (the assessment was implemented for all research participants in both the pre-test and post-test stages in order to monitor the effect of the program applied – fencing or PA).

**Results**

*Fencing Training Experimental Group (FTEG) – girls and Control Physical Activity Group (PACG) – girls*

The FTEG – girls (N = 10) and the PACG – girls (N = 10) were evaluated at the beginning of the research and once more at the end of the research.

![Figure 1. ADHD RS IV Questionnaire results – FTEG – Girls](image1)

The upper curve indicates the pre-test results of the FTEG – Girls, and the lower curve indicates the post-test results of the FTEG – Girls. It is vividly seen that all results after completing the Fencing Training program are lower than those at the beginning of the research with a minimum score of 3 (questions no. 9 and 17) and a maximum score of 17 (questions no. 3 and 15).

![Figure 2. ADHD RS IV Questionnaire results – PACG – Girls](image2)
The upper curve indicates the pre-test results of the PACG – Girls, and the lower curve indicates the post-test results of the PACG – Girls. Overall, it is seen that most results (except question no. 9) after completing the PA Training program are lower than those at the beginning of the research with a minimum score of 0 (question no. 9) and a maximum score of 11 (question no. 14).

Fencing Training Experimental Group – boys and Control Physical Activity Group – boys

The FTEG – boys (N = 10) and the PACG – boys (N = 10) were evaluated at the beginning of the research and once more at the end of the research.

![Figure 3. ADHD RS IV Questionnaire results – FTEG – Boys](image)

The upper curve indicates the pre-test results of the FTEG – Boys, and the lower curve indicates the post-test results of the FTEG – Boys. It is distinctly seen that all the results after completing the Fencing Training program are lower than those at the beginning of the research with a minimum score of 3 (question no. 17) and a maximum score of 16 (questions no. 7 and 8).

![Figure 4. ADHD RS IV Questionnaire results – PACG – Boys](image)
The upper curve indicates the pre-test results of the PACG – Boys, and the lower curve indicates the pre-test results of the PACG – Boys. Globally, it is seen that most results (except question no. 17) after completing the PA Training program are lower than those at the beginning of the research with a minimum score of 0 (question no. 17) and a maximum score of 15 (question no. 8).

The scoring sheets were marked according to the recommendations of the ADHD RS IV, and the data reliability was validated using the SSPS software.

**Statistical analysis – Cronbach’s Alpha**

For reliability statistics, the SSPS software was applied for each of the four distinguished groups – FTEG Girls, PACG Girls, FTEG Boys, and PACG Boys – using the combined pre-test and post-test results in order to get a thorough evaluation of the whole research expecting Cronbach’s Alpha values higher than 0.75.

![Cronbach's Alpha](image)

**Figure 5. ADHD RS IV Questionnaire – Cronbach’s Alpha**

The Cronbach’s Alpha values obtained in Figure 5 from the data gathered in both the preliminary and final tests (N = 20 per group) indicate a high correlation with each factor expressed by the questions in each group, even though the value for the Control Group – Girls is slightly lower than the expected 0.75. The inter-reliability of the questions is assumed and validated, but the Cronbach’s Alpha analysis cannot be used to demonstrate differences between groups. A 3-way Anova would be more appropriate, without repeated measures to show statistical differences, if any.

**Scoring Sheets**

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</table>

![Scoring Sheet for Girls](image)

**Figure 6. Raw scores and percentiles for the groups of girls**
Figure 7. Raw scores and percentiles for the groups of boys

Legend – for Figures 6 and 7:

= FTEG, pre-test

= FTEG, post-test

= PACG, pre-test

= PACG, post-test

Figures 6 and 7 show that, in the pre-test stage, both FTEG and PACG subjects fall into the “ADHD diagnosis” category.

After applying the intervention programs to FTEG and PACG, the ADHD RS IV was applied again (post-test), and it resulted that the average raw and percentile scores were lower than the pre-test scores.

Table 1. Pre-test and post-test mean values of raw scores and percentile scores according to gender and type of intervention program

<table>
<thead>
<tr>
<th></th>
<th>Fencing Group</th>
<th>Control Group</th>
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<td>33.9</td>
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<tr>
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<td>IA</td>
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</tbody>
</table>

Table 1 shows the main raw scores and their conversion into percentiles for the Inattention, Hyperactivity/Impulsivity and Total subscales, separately for boys and girls, for both the FTEG and the PACG. As can be seen, in all cases, there is an improvement in the condition of the group between the pre-test and post-test. Moreover, it can be seen that the Fencing Training program has contributed to reducing ADHD symptoms more than the PE program, namely: for the female gender, the Fencing Training program lowered the percentile by about 10 points, from 98 to 89, while the PE program lowered it only by about 5 points, from 98 to 93; for the male gender, the Fencing Training program lowered the percentile by 46 points, while the PE program lowered it only by 9 points. Boys were more influenced by physical activity than girls in both the Fencing Experimental Group (46 points against 10 points for girls) and PACG (9 points against 5 points).
Conclusions

The objective of the research was to explore the existence of extra value in the Fencing Training program compared to the General PA program. The concluding results, as reflected by the ADHD RS IV Questionnaire regarding both Inattention and Hyperactivity/Impulsivity aspects, indicate better results for the Fencing Training program than the PA program.

The Inattention data show that the difference between the values of ADHD RS IV odd questions in the preliminary stage and its values in the final stage of the Fencing Training Experimental Group (193) is much greater than that of the Physical Activity group (52) and actually the FTEG superiority persists in all questions.

The Hyperactivity/Impulsivity data show that the difference between the values of ADHD RS IV even questions in the preliminary stage and its values in the final stage of the Fencing Training Experimental Group (180) is slightly greater than of the Physical Activity group (162).

According to Geritsidou (2016), a child can be eliminated for ADHD if his or her score is: for Inattention, equal or under the 90th percentile; for Hyperactivity/Impulsivity, equal or below the 75th percentile; for both characteristics, equal or less than the 80th percentile. It follows that the FTEG subjects can be excluded from the diagnosis of ADHD.

Based on the results of this research, it can be stated that the specific Fencing Training program can assist in reducing ADHD symptoms: Attention, Hyperactivity/Impulsivity and the interaction between them.

Further research in the field is recommended with a larger number of participants in order to avoid statistical validity concerns, but for a shorter period of time and by increasing the training density during the week – the shorter time of such a program can prove to be effective if it is more flexible to be assimilated within formal school programs. It would also be interesting to conduct a similar research with another exclusive type of physical activity like wrestling, judo etc.

References


IMPULSIVITY AND IRRATIONAL BELIEFS OF INJURED BASKETBALL PLAYERS

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Abstract. Professional basketball players can reach and maintain a high level of competence when their training programs consist in a combination of knowledge related to the field of sport. Participation in sport competition results in a great potential for physical injury, with high costs involved in player rehabilitation. Besides the physical aspect, the injured basketball players can display a variety of psychological responses to injury: cognitive reactions, like irrational beliefs and changes in self-esteem, emotional responses, like depression, anger and frustration and behavioural responses, as adherence to rehabilitation and the use of coping mechanisms. This paper aims to identify and to understand the phenomenology and behavioural reactions of the subjects, professional basketball athletes, at the time when they are experiencing a traumatic injury. Thus, we have assumed that there are significant positive correlations between certain investigated variables, such as impulsivity and the level of irrational beliefs of athletes injured during sports competitions.

Keywords: basketball players, irrational beliefs, traumatic injury.

Introduction

As a professional sport, basketball is built around an efficient cooperation between coaches, doctors, physiotherapists, sports psychologists and all other professionals involved in the training process. Four specific types of training are included in each phase: physical, technical, tactical and psychological (O’Connor et al., 2005; Rizeanu & Bratu, 2018).

Each phase brings a specific contribution to the success of an athlete; however, the interaction between the four training phases becomes a determining factor in the quality of the sports practice and results in the performance of athletes and team (Blumenstein, Lidor, & Tenenbaum, 2005). Long-term empirical studies support the idea that, in addition to physical training, appropriate psychological techniques to enhance sport performance ensure effective mental training for practice and competitions for professional athletes (Bratu & Rizeanu, 2018; Epuran et al., 2006; Kolt & Snyder-Mackler, 2007). We mention that, in competition, irrational beliefs such as “I must necessarily win at any cost!” or “It’s awful if I do not win” can manifest, and if these inflexible formulations are not confirmed, athletes may experience negative emotions and depression. Therefore, formulations such as “I would like/ It would be a good thing to win!” are preferable; the player is motivated and at the same time flexible (Predoiu, 2016, p. 77).

The main objective of the competition is to use all factors specific to the motor and psychological abilities of the athletes, so that the maximum performance can be achieved (Bompa & Buzzichelli, 2015). More specifically, in the competition phase, athletes display and use their specific sports skills and psychological training, improve their level of fitness and technique, refine their tactics and strategies implemented during training and games maintaining as high as possible their level of general competencies (Rizeanu, Bratu, & Rizeanu, 2017).

Due to its peculiarities, the rules of the game and the fair-play, etc., basketball is among the sports games with the fewest macro post-traumatic disorders by direct contact, but any individual who practices this sport, regardless of its form, is at risk of injury (Albină et al., 2014).

Starting from the premise that any athlete who suffers a trauma (an accident, injury) will have to face a range of physical, mental, interpersonal and psychosocial criteria in the process of healing and recovery, we consider it essential to understand the psychological status and the effects of injuries produced in sports, specifically in the game of basketball, on the athletes’ lives (Nicolas et al., 2019).

Objectives and hypothesis

The objective of our paper refers to the identification of correlations between certain psychological variables, namely impulsivity and the existence of irrational beliefs in the basketball players injured during the sports competitions.

The hypothesis is that a significant positive correlation between the irrational beliefs and the impulsivity level of the injured basketball players is anticipated. In other words, the stronger the overall irrational beliefs are, the more likely the chances that the level of impulsivity is obviously present.
Material and methods

Participants

In order to validate our hypothesis, we proceeded to analysing an experimental group of young athletes (N = 30), professional basketball players diagnosed by the orthopaedic specialist physician with orthopaedic injuries. The experimental group consists of 17 male subjects (m = 17) and 13 female subjects (f = 13) aged between 20 and 32 years, the mean age being (M = 22.07).

Instruments

We used the following research instruments:

Irrational Belief Scale, IBS (Malouff & Schutte, 1986) – is an instrument consisting of 20 items measuring the 10 irrational beliefs, that is to say the need for approval from others, need for achievement, catastrophising, avoidance, the importance of the past etc., described by Ellis and Harper (1975), to which participants respond on a scale from 1 (“I do not agree”) to 5 (“I fully agree”). Malouff and Schutte (1986) reported test-retest reliability coefficients r = .89 (N = 80) and a Cronbach’s Alpha coefficient = .80 (N = 80). Scores range from 20 to 100 points obtained by summation, high values showing a high level of irrational beliefs in the interviewed subjects.

Barratt Impulsiveness Scale, BIS-11 (Patton, Stanford, & Barratt, 1995) – is a self-assessment questionnaire containing 30 items. Subjects respond using a Likert 4-point scale that has the role to capture individual impulsivity (Patton et al., 1995). Stanford et al. (2009) reported that the total scores on BIS-11 demonstrated reasonable reliability of testing-retesting over one month (Spearman’s rho = .83) and a Cronbach’s Alpha coefficient = .83. For this research, a number of 11 items are used, which refer to impulsivity with motor determinants and impulsivity with motor determinants achieved by perseverance, respectively items 2, 3, 4, 17, 19, 22, 25 (IMDP), and 16, 21, 23, 30 (IMDP). The total score is achieved by summation, high values showing a high level of impulsivity in subjects.

Procedure

The participants who made up the group of elite/professional basketball players were tested before the start of the training, in the preparation phase, the working environment being organized, without obvious sources of distraction.

Results

The results obtained by the athletes who formed the experimental group of basketball players diagnosed by the orthopaedic specialist physician with orthopaedic injuries showed, for the Irrational Beliefs Scale, a mean of 73.76, which indicates a high level of perceived irrational beliefs (Table 1). The standard deviation of the scores was 3.47, and the value of the median and the mode was 74.

Table 1. Descriptive statistics for the Scale of Irrational Beliefs in the experimental group (N = 30)

<table>
<thead>
<tr>
<th>N</th>
<th>Valid</th>
<th>Missing</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>Mean</td>
<td>73.76</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>74.00</td>
<td></td>
</tr>
<tr>
<td>Mode</td>
<td>74.00</td>
<td></td>
</tr>
<tr>
<td>Standard deviation</td>
<td>3.47</td>
<td></td>
</tr>
<tr>
<td>Variant</td>
<td>12.04</td>
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</tr>
<tr>
<td>Skewness (asymmetry)</td>
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<td></td>
</tr>
<tr>
<td>Kurtosis</td>
<td>.14</td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>67.0</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>81.0</td>
<td></td>
</tr>
</tbody>
</table>

Subjects’ responses ranged between 67 and 81 – 67 points for the minimum score (low level of irrational beliefs) and 81 points for the maximum score (high level of irrational beliefs). As can be seen in the frequency table (Table 2), the scores declared for the level of irrational beliefs by the subjects of this group are distributed as follows:

- a percentage of 6.7% of basketball players declared a low level of irrational beliefs;
- 63.3% of the interviewed subjects reported a moderate level of irrational beliefs;
- a percentage of 30% reported a high level of irrational beliefs.

Table 2. Frequencies for the Scale of Irrational Beliefs in the experimental group (N = 30)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percentage</th>
<th>Valid percentage</th>
<th>Cumulative percentages</th>
</tr>
</thead>
<tbody>
<tr>
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<td>6.7</td>
<td>6.7</td>
</tr>
<tr>
<td>69.00</td>
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<td>3.3</td>
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<td>70.00</td>
<td>2</td>
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<td>6.7</td>
</tr>
<tr>
<td>71.00</td>
<td>3</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>72.00</td>
<td>1</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
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<td>13.3</td>
<td>13.3</td>
</tr>
<tr>
<td>74.00</td>
<td>6</td>
<td>20.0</td>
<td>20.0</td>
</tr>
<tr>
<td>75.00</td>
<td>3</td>
<td>10.0</td>
<td>10.0</td>
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<tr>
<td>76.00</td>
<td>2</td>
<td>6.7</td>
<td>6.7</td>
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<tr>
<td>77.00</td>
<td>3</td>
<td>10.0</td>
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<tr>
<td>79.00</td>
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<td>81.00</td>
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<td>6.7</td>
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<tr>
<td>Total</td>
<td>30</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The data obtained for the variable of irrational beliefs are graphically represented in Figure 1, after the grouping operation by interval class. As can be seen, the scores for irrational beliefs form a positive asymmetric unimodal distribution, asymmetry also shown by the positive value of the asymmetry index (0.11).

![Figure 1. Score distribution of Irrational Beliefs in the experimental group](image)

This fact denotes a slight shift of the scores to the left, representing the tendency of the subjects to obtain more scores around and above the average. The figure has a leptokurtic aspect, the flattening index of the curve (kurtosis) being positive (0.14), which indicates a low dispersion of the scores obtained by the subjects around the central tendency and a minimum variation of the scores.

When we applied the BIS-11 impulsivity scale, we obtained an average impulsivity value of 29.60, which is in the range of a high level of perceived impulsivity (Table 3). The standard deviation of the scores is 1.69; the median is 30 and the mode, 31.
Table 3. Descriptive statistics for the Impulsivity Scale in the experimental group (N = 30)

<table>
<thead>
<tr>
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<tbody>
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<td>Mean</td>
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<tr>
<td>Median</td>
<td>30.00</td>
<td></td>
</tr>
<tr>
<td>Mode</td>
<td>31.00</td>
<td></td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.69</td>
<td></td>
</tr>
<tr>
<td>Variant</td>
<td>2.86</td>
<td></td>
</tr>
<tr>
<td>Skewness (asymmetry)</td>
<td>-0.13</td>
<td></td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.60</td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>26.00</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>33.00</td>
<td></td>
</tr>
</tbody>
</table>

Subjects’ responses ranged between 26 and 33 points representing the minimum score (average level of motor impulsivity and perseverance in its determinants) and 33, the maximum score (high level of motor impulsivity and perseverance in its determinants). As can be seen in the table of frequencies (Table 4), the scores declared for the level of impulsivity by the subjects of this group are distributed as follows:

- a percentage of 62.3% of basketball players declared an average level of motor impulsivity and perseverance in its determinants;
- a percentage of 37.7% reported a high level of motor impulsivity and perseverance in its determinants.

Table 4. Frequencies for the Impulsivity Scale in the experimental group (N = 30)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percentage</th>
<th>Valid percentage</th>
<th>Cumulative percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>26.00</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>27.00</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td></td>
<td>28.00</td>
<td>6</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td>29.00</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>30.00</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>31.00</td>
<td>8</td>
<td>26.7</td>
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<tr>
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<td>32.00</td>
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<td>3.3</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 2. Score distribution of Impulsivity in the experimental group

The data obtained for the impulsivity variable are graphically represented in Figure 2. As can be seen, the impulsivity scores form a negative asymmetric multimodal distribution, asymmetry also shown by the negative value of the asymmetry index (-0.13). This fact denotes a slight shift of the scores to the right, representing the
tendency of the subjects to obtain more scores that exceed the value of the central tendency. The histogram has a mesokurtic aspect, the flattening index of the curve (kurtosis) being negative (-0.60), which indicates an average dispersion of the scores obtained by the subjects around the central tendency.

In order to verify our hypothesis, we calculated the Pearson statistical correlation (r) between the level of irrational beliefs and the level of impulsivity of the injured athletes, and the results obtained allowed us to state that the hypothesis was validated.

Table 5. Irrational beliefs and impulsivity – calculated correlation coefficients, their corresponding confidence interval and corrected coefficients for reliability attenuation

<table>
<thead>
<tr>
<th>Irrational beliefs</th>
<th>Impulsivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>calculated r</td>
</tr>
<tr>
<td>Irrational beliefs</td>
<td>.57**</td>
</tr>
</tbody>
</table>

Note: Experimental group: N = 30, **p < .01

Conclusions

In the event of traumatic injuries suffered by professional athletes, we propose the implementation of physical and psychological recovery techniques that can play an important role in deepening the self-balance and concentration, counteracting the effects of the injury experienced.

The issue is not aimed to completely eliminate the pain, but only to turn it into a factor of optimising the condition by actually putting the self-control process into effect.

We propose a general working hypothesis for a future research that suggests the existence of associations between the level of injuries, injuries suffered by basketball players and the type of rehabilitation methods (Santi & Pietrantoni, 2013).

Starting from the fact that the coach and the kinesiotherapist, together with the clinical sports psychologist, can provide athletes with useful methods for the purpose of preventing injury, we also propose a hypothesis that suggests the importance of using psychological strategies and methods of prevention in this respect, in accordance with the physical rehabilitation techniques (Kellmann, 2010; Weinberg, Vernau, & Horn, 2013).

References


OPTIMISATION OF COACH-ATHLETE COMMUNICATION

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Abstract. Communication is known as a vital interpersonal ability; it is the foundation on which relationships are initiated, maintained, negotiated or dissolved and also an important tool for effective coaching. The coach-athlete relationship is based on the communication process, which includes the transmission of competence, knowledge and skills. Studies have shown that good communication (which occurs when the athlete knows that the coach really notices how they perform, recognizes their effort and provides positive or negative but constructive, honest and precise feedback) makes all the difference. As a result of the communication process, the psycho-behavioural repertoire of both the coach and athletes expands. However, to achieve this goal, the communication style used is very important. The communication style refers to the way in which either the coach or athlete transmits verbal, nonverbal and paraverbal information. Four communication styles can be distinguished: non-assertive (passive escape behaviour), aggressive (attack behaviour), manipulative, and assertive (constructive behaviour). For better communication with athletes, the development of empathic ability and active listening are particularly important.

Keywords: communication, athlete, coach, sport.

Introduction

The term communication originates from the Latin communis, meaning common or shared. The concept of communication has a multitude of definitions and meanings, given the very complex character of the phenomenon. As stated by Pânişoară (2015, p. 14), the researcher is offered an extremely wide range of possibilities, but which are difficult to “capture” in a global approach; thus, communication can get the meanings of linguistic, psychological and psychosocial, philosophical, mathematical or pedagogical definitions, and not only.

In the broadest sense, communication refers to any exchange of matter, information and/or energy between two or more systems, or within the same system, between two or more subsystems. In fact, as noted by Walton (2007, p. 40), although there are multiple possibilities to define communication, the notion of information transfer is at the core of all these definitions. Each form of organisation of matter has a corresponding type of communication with the environment (Golu, cited by Şchiopu, 1997). Therefore, any system communicates with the environment to which it must adapt. However, the sphere of definitions does not simply stop at the transmission of information. Thus, the crucial element in describing communication is meaning (Guffey & Loewy, 2014, p. 122). We tend to agree with the two authors, especially because communication involves expressing messages and interpreting them, which leads to a meaningful relationship between two or more people (Cleary, 2009), and the communication process is “always changing, dynamic and reciprocal” (Ross, 1986, p. 9). For Rothwell (2015, p. 11), communication is obviously and first of all a process, because “changes in events and relationships are part of continuous flow”. Finally, Lustig and Koester (2007, p. 46) manage to provide a comprehensive view of the issue, noticing that communication encompasses a transactional, interpretative, symbolic and contextual process in which people create shared meanings.

Ruesch and Bateson (2008) highlight four levels of communication, depending on the field of relationships taken into account by the “external” observer: intrapersonal (self-communication), interpersonal (between two people), group (between more people) and cultural (between numerous people).

From a psychosocial point of view, communication involves interhuman relationships, interaction and mutual influence. Communication is the relationship by which interlocutors can understand each other and influence each other through the continuous exchange of variously encoded information. Individual communication:

- is based on the transmission by words of the subjective mental content, the transposition of thoughts into words to be transmitted;
- is intentional, rational and voluntary, and can be assessed; thus, one can say whether it is normal or pathological, efficient or inefficient, correct or wrong, etc.

Topic addressed

There is a strong connection between the communication skills of athletes, the quality and efficiency of coach-athlete communication and sports performance, and syncopes in the development of athletes are often related to
communication problems. Through communication, coaches convey expectations, standards, goals, but also emotions. It is important for the two parties to establish positive energetic relationships, “otherwise the process of transmitting information (regarding technical elements, tactics, recovery, hydration, nutrition, recreational activities, sex life, etc.) is affected” (Predoiu et al., 2019, p. 20).

For better communication with athletes, the development of empathic ability is particularly important. Empathy is the coach’s ability to understand and share the feelings of another. It means intuition of what the other is experiencing, but without ignoring that you are yourself, in which case it would be about identification (Doron & Parot, 2007, p. 284). Thus, the coach becomes able to think like the other, to experience the emotional states of the other, to behave like the other, performing a “simulation” in the mental space of “the other” – all of this allowing the coach to clearly understand the other’s point of view and behaviour. As noted by Stebnicki (2008, p. 33), “the underlying premise of acting empathically is that our compassion for another human being moves us so deeply that we instinctually have a desire to help that individual”.

If the coach shows empathy for athletes, this behaviour can also become an important way to develop their empathetic ability. Actually, research shows that empathy is a phenomenon with multiple effects on human relationships, “a multidimensional phenomenon that inevitably includes both cognitive and emotional components” (Davis, 2007, p. 443). In empathic listening, the coach pays attention to the verbal message, the paraverbal and nonverbal aspects, but also to the emotions and feelings expressed by the athlete (Predoiu, 2016).

At the end of the last century, the research carried out at the University of Parma by Rizzolatti and co-workers (Gallese, Fogassi, Fadiga, etc.) regarding mirror neurons demonstrated the existence of neurological support for both the human ability to establish connections with other people (and generally with any being), understand their behaviour, empathise with them, and the mechanism of learning by imitation, which are fundamental elements for the formation of human consciousness (Mitrache, Tüdös, & Predoiu, 2018). The mirror neuron system, initially discovered in 1996 (in macaque monkeys), and in the early 2000s, in humans, represents a special class of nerve cells with a particular role in the direct, automatic and unconscious reception of signals from the social environment, explaining the imitation and empathy phenomena (basic phenomena of the capacity for social integration, understanding social behaviour, forming social relations, socialising). Mirror neurons are found in the frontal lobe (Spaulding, 2013).

What happens in this system as a result of communication? According to the communication model developed by Meyer-Eppler (cited by Nöth, 1995) (Figure 1), participants in communication have a certain repertoire (system of knowledge, abilities and skills, experience, etc.).

![Figure 1. The scheme of interpersonal communication (after Meyer-Eppler)](image)
The communication style used is very important for optimising coach-athlete communication. It reflects the way in which the coach or athlete transmits verbal, nonverbal and paraverbal information (Norton, 1978). Table 1 shows the four communication styles, their characteristics, as well as the advantages or disadvantages associated with the use of a particular style.

Table 1. Communication styles – Advantages or disadvantages (Mitrache et al., 2018)

<table>
<thead>
<tr>
<th>Communication style</th>
<th>Characteristics</th>
<th>Advantages or Disadvantages?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-assertive (passive escape behaviour)</td>
<td>The tendency to show avoidance behaviour by the attitude of escaping or hiding rather than directly facing situations and people, the tendency to postpone decision-making and often the impossibility of making decisions, accompanied by the attitude of allowing others to decide for them. The person can be excessively kind and conciliatory in their desire to avoid conflicts, using the indirect communication of own desires with the intention of pleasing others, according to the principle: “My feelings do not matter; only what you think and want is important”.</td>
<td>Non-assertive people fail to properly manage their resources (mental and physical energy, time, material and financial resources) and consequently have low adaptation efficiency. They are more vulnerable to stress, given that non-assertive behaviour is often accompanied by a series of negative emotional experiences such as anxiety and frustration.</td>
</tr>
<tr>
<td>Aggressive (attack behaviour)</td>
<td>It is characterised by the person’s desire to dominate at any price, even to the detriment of others, by bothering, insulting or humiliating them. The guiding principle of their communication is: “I think this, I want this, what you want does not matter to me”. The person with an aggressive communication style shows superiority and contempt for others and, in order to dominate at all costs, may use improper and brutal means.</td>
<td>This communication style limits adaptation, because it triggers aversive reactions from others, causes the dislike and even aggression of others, leading to the creation of a true “vicious circle” of aggression.</td>
</tr>
<tr>
<td>Manipulative (manipulative behaviour)</td>
<td>People characterised by a manipulative style express their preference for a backstage role. They have the tendency to wait for the right moment to self-assert and to suspect hidden intentions behind any statements of others. Such people avoid saying openly what they think and actually one never knows if they tell the truth or not, because they change their opinions to match those of the interlocutor, depending on their own interests; they like to be around powerful people.</td>
<td>People in this category seek to make others do what they would like, provided that this does not involve open confrontations – be they rational, constructive (assertive type) or conflictive (aggressive type); it is rather about waiting for the situation to turn in their favour. It is preferable for coaches and athletes to use persuasion instead of manipulation to reach the desired result.</td>
</tr>
<tr>
<td>Assertive (constructive behaviour)</td>
<td>Assertive people have the ability to directly say what they think, feel and want, managing to defend their desires while respecting others. Assertiveness is a characteristic of people who easily express their points of view and interests without anxiety.</td>
<td>This is the best behaviour, because it allows reaching the proposed goals without causing the resentment of others and even often gaining their sympathy. The assertive style is important to be educated and enhanced, the level of assertiveness positively correlating with the level of self-confidence and self-assurance. Assertive behaviour involves respect and consideration for one’s own person and the people around.</td>
</tr>
</tbody>
</table>

As regards the aggressive style, studies highlighted significant differences between athletes (practicing martial arts, football and handball) and non-athletes, in the sense that athletes had higher scores for aggressive behaviour (Predoiu & Radu, 2013). But why is the aggressive style chosen? According to Gamble and Gamble (2013, p. 312), this choice relies on four reasons:

- people feel vulnerable and thus try to self-protect from threats;
- unsolved emotional problems may lead to overreaction in conflictive situations;
- people have the impression that only in this way they can reach their goals;
people do know how to control their aggressive impulses.

This is why it is important for the coach to show interconnection, empathy and communication skills that provide the key to solving such problems in the relationship with athletes. We recommend assertive training for the development of communication skills in coaches and athletes (for the stages of assertive training, see Predoiu et al., 2019).

Hackman and Johnson (2004) state that our communication style contributes to the success or failure of any attempt to exert social influence (it is worth noting that coaches must be able to influence athletes in the instructive-educational process). According to Prutianu (2004), the main forms of communication specific to the coach-athlete relationship in performance sport are: direct order, command, suggestion of action, individual or group (team) discussion, speech, demonstration and analysis. The information provided by the coach must be clearly presented, reiterated after each execution, formulated in terms that can be easily understood and often accompanied by pictures or videos. The coach can optimise the time allocated to the transmission of information during the training process by clarity, concision and correct terminology. Effective communication with athletes depends on the spoken or written, direct or indirect, authoritative or permissive, persuasive or usual words. The efficiency of even a single word (verbal formulas used for the athlete to focus on the current task, words used to increase the athlete’s self-confidence at different times of the game) can be emphasised in critical situations occurring during the competition. The verbal formulas accepted and understood by athletes can contribute to triggering a very wide range of mental and psycho-physiological functions (adapted after Gheorghiu & Ciofu, 1982).

Optimisation of coach-athlete communication through factors that “over-encode” communication:

1. Visual contact – is a particularly important way of both influencing the receiver of the message (therefore, a way of transmitting nonverbal information) and achieving self-regulation (obtaining feedback information). The duration and type of visual contact that coaches have with athletes are important indicators of the relationship with that person. Moreover, visual contact “includes how often and for how long a person looks at someone else and whether that gaze is returned” (Williams, 1997, p. 9).

According to Knapp and Hall (2009), visual contact or gazing has several important functions: regulating the flow of communication; monitoring feedback; expressing emotions; reflecting cognitive activity; communicating the nature of the personal relationship. To these, Ellgring (2007, p. 85) adds that, by visual contact, we can … avoid communication with the other. Establishing visual contact with the athlete plays a decisive role in regulating, facilitating and optimising communication, in supporting the verbally transmitted information.

2. Facial expression – is one of the most important nonverbal signals. Starting from its decoding, a fine observer can obtain important information about a specific person. The main impediment is the inaccuracy of decoding such signals.

This is very well illustrated by Samovar, Porter and McDaniel (2009, p. 260), who say that “while there is a biological component to facial expressions, culture plays a major role in what produces the facial expressions, how the expression is displayed, and the meaning attached to the facial expression”. More clearly, it is obvious that facial expressions are universal, but decoding them requires us to have an integrated perspective, or, as Balconi (2010, p. 204) says: “As integrated message, the combination of words, facial expressions, gestures, etc., is an important feature of conversational language”. The effective use of communication involves a broad vision in which all aspects must converge into a unitary, coherent and conclusive vision. In this regard, Hayes and Orrell (1996) point out that, as far as known, there are at least 8 different positions of the eyebrows and forehead, more than 8 positions of the eyes and eyelids, and at least 10 positions for the lower face, each of them with its own significance. Given that the facial expression is a result of their combination, obviously the number of possibilities is extremely high. In addition, facial expressions have very high mobility, some of them lasting only 5 thousandths of a second (micro-expressions). However, all of them transmit signals, which, if decoded with the same fast speed, communicate certain information to others.

There are 7 groups of facial expressions that are common to all societies and are supposed to be innate: happiness, sadness, fear, disgust, anger, contempt and surprise. By the end of the 1800s, Charles Darwin was the first to suggest that facial expressions of emotion are similar anywhere in the world, because they are innate. At that time, most members of the scientific community disproved this theory. Only by the end of the 20th century, Paul Ekman and his team researched emotional expressions, confirming their universality (“The Seven Universal Facial Expressions”, 2018). To better understand athletes, coaches can train their ability to decode emotional expressions (for this, the following online sources are available: “A Short Test on Recognizing Facial Expressions”, 2019; “Test Your Emotional Intelligence”, n.d.; “Micro Expressions Test”, n.d.).
3. Speech rhythm – when the information provided to athletes is new, a slower pace is recommended (at the same time, coaches should be flexible, because slow speech can be boring). This is clearly highlighted by Poyatos (2002, p. 20): “The combinations of different patterns of pitches, loudness, syllabic duration and speech tempo produce as we speak variations in the rhythm of that verbal-nonverbal flow […], from very smooth to very jerky”. Also, voice inflections express more strongly what the coach wants to be understood by athletes, and putting emphasis on an idea or an important detail captures the attention, enlivens the message, transmits energy and impresses.

4. Space, territory – can be defined as follows: “A territory is a fixed geographic area that is occupied, controlled and defended by a person or group as their exclusive domain” (Burgoon, Guerrero, & Floyd, 2016, p. 159), or “Personal territories include such spaces as individual’s house, car or favourite chair” (Watson & Hill, 2015, p. 302). Therefore, we, the people, are territorial beings, and somebody’s act of trespassing/intruding on the territory that we own can be stressful for us. This becomes even clearer when it comes to the space itself. Thus, being too close to athletes when transmitting information generates discomfort and lack of friendship. We should not forget about intimate distance, which is from the surface of the body to an arm’s length, according to Hall (1966). This author differentiates between the following interpersonal distances: intimate distance; personal distance; social distance; public distance.

Bîltac and Călin (2008) underline the idea that the training process is par excellence a coach-athlete communication process during which they permanently exchange messages whose main purpose is to achieve pedagogical objectives in optimal conditions. The coach and athletes cooperate and act together for a shared goal: carrying out an effective training process and achieving performance. Athletic performance also depends on compatibility, cohesion and the ability to reach consensus (Hackfort, Schinke, & Strauss, 2019). To support these assertions, we present the Four-Sides Model (also called the Four-Ears Model) developed by the specialist Schulz von Thun, a well-known German psychologist (Fierro-Evans, 2015). This model claims that a statement provided by a person has four different effects. Each of the statements contains, whether we want it or not, four simultaneous messages:

- factual information (details, events, facts) – blue;
- a self-statement (what I show of myself) – green;
- a relationship indicator (what I think about you and how I relate to you) – yellow;
- an appeal (what I want you to do) – red.

The classic example offered by Schulz Von Thun is the following: he and she in the car at the traffic light, which is red. When the traffic light changes colour, she tells him: “It is green!” He can interpret the message in four different ways (“The Communication Model by Schulz von Thun”, 2010):

- from the perspective of factual information (with an informational role) – “It is green”, and nothing more. In terms of conversation, factual information stands in the foreground, and the focus is on data, facts or events (Naue & Möller, 2010). While the sender transmits the information (clearly, concisely and coherently), the receiver evaluates the data according to three criteria: the truth criterion (is the information true/false, correct/incorrect?), the relevance criterion (is the information significant or not for the time and context in which communication occurs) and the sufficiency criterion (are the listed factual indicators sufficient or not for the issue or do many other things also need to be considered?). In this case, the receiver’s response can be: “I understand, I start it!” or “Ok, thank you!”
• from the self-disclosure perspective (what the statement says about the sender) – when someone provides a statement (St. Pierre, Hofinger, & Buerschaper, 2008), they also provide a part of themselves (personality, way of thinking, how they feel at that moment, what happens inside them, etc.). Thus, the receiver can understand: “She is worried that we will be late”, “She is in a hurry” or “She does not think that I am a good driver” and will answer: “Do not worry, we will be there on time!” or “Trust me, I drive well!”

• from the relationship perspective – either we want it or not, when we address someone, we also transmit information about our relationship with that person and what we think about that person (through formulation, intonation, emotional charge, etc.). The one who receives the information will understand: “You are not careful!”/“You are wrong again!” or “We will be late because of you!” and can answer: “You criticise me all the time!”, “You do not even let me drive!” or “It is not my fault that we are late!”

• from the appeal perspective (what expectances the sender might have) – when we address someone, we usually want to create an effect, to have an influence. This perspective is about desires, appeals, advice, instructions, effects, etc. Therefore, the appeal ear is especially open to questions such as: “What should I do?”, “Do you want me to drive faster?” or “How can I do it?”

Knowing these four perspectives of transmitting and receiving the information, we can adapt our communication with athletes according to their responses, this model also representing a way to know or verify how they receive the information. Most often, athletes (like all of us, as a matter of fact) have one ear more sensitive than the other. Certainly, everyone knows people/athletes who interpret even simple messages as criticism or accusations, which means that they have a penchant for using the relationship ear. But other athletes are permanently waiting for indications, advice or instructions from the coach. In the coach-athlete relationship, if the receiver is not sure of the message content, it is very important for them to ask questions in order to clarify the situation or at least to allow a waiting time to see what else the other has to add.

Conclusions

It is thought that successful communication between coach and athlete is the measure of success in the activity of learning, enhancing or perfecting the motor actions taught. By knowing the particularities of athletes, the coach can approach them at their level of understanding, using the appropriate language to transmit the intended message.

In order to optimise communication with athletes, it is important for the coach to be aware of what, how and when they communicate. We conclude with the following recommendations for coaches:

• identify blocks in your communication with athletes (do not deviate from the topic, do not threaten your athletes, do not label them, use criticism in a constructive way being careful of the right place and time – not in the presence of others, not too soon or too late after a competition);

• harmonise your verbal communication with nonverbal and paraverbal communication (nonverbal communication and paraverbal communication, on the one hand, escape conscious control, and on the other hand, are faster decoded by the receiver; therefore, there is a risk for the athlete to receive nonverbal messages that distort or even contradict the verbal message if they are not in harmony with the verbal message);

• be fair, honest, knowing that personal harmony is reflected in the act of communication;

• be careful with your athletes, try to support them and positively assess them (we should not forget that the self-image of children is built by internalising the judgments of others);

• develop your ability to listen – empathic listening and active listening. Paraphrasing is very useful when the coach wants to minimise the occurrence of misunderstandings. Examples of formulations: in other words …; what you are telling me is …; I understand that …; what you feel is …, etc. If athletes also use active listening, they have better chances to become receptive to the new information and ideas put into question.

Authors’ Contributions

All authors contributed equally to this study and should be considered as main authors.

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PARTICULARITIES OF PLAY IN CHILDREN WITH AUTISM SPECTRUM DISORDERS

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Abstract. It is unanimously acknowledged that, although each stage of our lives gives play a form and importance, childhood, especially early childhood, is by excellence its grace period. Playful activities, the most important ones in this period, concentrate so much the child’s mental and physical energies that some psychologists (Sutton-Smith, 1997) have even questioned their proper definition as a play, they considering that terms such as “exploration”, “knowledge” or “work” are much more appropriate to name the children’s “play” in their first years of life. However, it is important and unanimously accepted that, until school age, playful activities are the main way for the child to know, learn and express themselves. They provide room not only for cognitive exploration, but also for knowledge and self-knowledge. Both in the first years of life, but especially later, at school age, the child will learn and practice, through social games played with other children, the rules operating in the social environment, which become increasingly complex with age. From this perspective, a statement made by Vygotsky, one of the important play theorists, is extremely suggestive: “In play, the child always behaves beyond his average age, above his daily behaviour […]. As in the focus of a magnifying glass, play contains all developmental tendencies in a condensed form and is itself a major source of development” (Jordan, 2003, p. 349).

Keywords: autism, atypical play, stereotype.

Introduction

Defining play, which apparently should have been an extremely easy and simple matter, has eventually proven to be a much more complex endeavour that raised numerous detail-related problems. The first attempts to define play belong to Jean Piaget (1896-1980), who is considered by many researchers to be the father of paediatric psychology. Observing his own children, Piaget defines play (which, in its earliest form, appears at 1 month and 16 days, according to the author) as an activity that produces a state of relaxation and good mood, an activity that the child performs by ignoring its purpose and focusing on the action itself. In the next century, all those who tried to encompass it into definitions have kept as a defining feature just this transfer of attention from the purpose of an action to the action itself, which thus becomes an end in itself for the child.

Careful observation and critical analysis of autistic children’s play in the preverbal period are the main sources of information for establishing an early diagnosis, namely before the age of 4-5 years, which is typical for the manifestation of autism and the age at which an accurate diagnosis is usually established. In this context, the debated points focus on the lack of variety in the imaginative and imitative play and the failure to build friendly relations with children of the same age, which are the characteristic features of autistic children. In order to operationalise these diagnostic criteria included in the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition), standardised diagnostic instruments have been developed, including the ones mentioned below.

The Diagnostic Interview for Social and Communication Disorders (DISCO), one of the latest instruments for diagnosing pervasive developmental disorders, includes special items designed to assess social play and imaginative play.

The Pre-Linguistic Autism Diagnostic Observation Schedule (PL-ADOS), another supportive diagnostic tool consisting in a semi-structured interview designed for nonverbal autistic children aged less than 6 years old, minutely observes how autistic children interact with play partners and how they use toys.

The Childhood Autism Rating Scale (CARS) dedicates one of its 15 scales to the investigation of particularities characterising the child’s interaction with inanimate objects such as toys or things in the surrounding environment (Jarrold, 2003).

The Checklist for Autism in Toddlers (CAT), an autism screening tool, also contains items dedicated to symbolic play and social play (Baron-Cohen, 1987).

It is worth mentioning that autistic children’s play is not only a defining part of specific symptomatology, but also a starting point in the study, if not of the direct causes, at least of the neurocognitive and emotional defects that mediate the existence of the disease-specific symptomatic picture. Much debate has arisen around the pathology of autistic children’s play, particularly regarding the role of emotional and socialisation impairments, or the cognitive ones, namely the deficits in the formation of abstract, symbolic thinking and those related to the performance of central executive functions.
Current level of knowledge reflected in the literature

At the beginning, play is learned during the first acts of communication, initially from the mother, and then from the other members of the social group (Kok, Kong, & Bernard-Optiz, 2002). But gradually, with the emergence of the creativeimaginative forms of activity, play becomes itself a form of expression with its own rules, like language and art, which it usually precedes in terms of emergence (Sutton-Smith, 1986). What participants in the act of play are trying to communicate requires a specific way of encoding and transmission, and the exaggerations, characteristic sounds and specific mimicry are not only identification signals such as “now we are playing”, but are part of the play structure itself, are its “language” (Libby et al., 1998).

A particular issue is that communication through play is paradoxical because it joins opposites, which means that, unlike common language, it encodes not only a specific message, but also the signals warning that actually the message is not a real one.

Play involves knowledge and is equally knowledge whose forms become increasingly complex. Thus, the first play activities that occur in the child’s evolution are exploratory in nature and mainly lead to the sensory “knowledge” of objects. They are followed by simple, repetitive play that, as a result of successive cognitive acquisitions, turn into relational, constructive play. Gradually, through playful activities, the child manages to solve cognition problems starting from the exploration of physical properties of the objects used. The child thus prepares the emergence of higher forms of play, namely the imaginative and symbolic ones. It is worth mentioning that the completion of a new stage does not exclude the previous one, but is added to it, so that the child is able at a certain point to play according to all the previously completed stages (Williams, Reddy, & Costall, 2001).

Perhaps most important, from the perspective of the topic addressed, is a specific aspect of play, namely the one that regards play as an opportunity for building and developing social skills. Schematising the complexity of everyday life, play prepares the child for real confrontation with it. The emergence and development of social skills, as reflected in children’s play, occur in stages that seem to be faithful replicas of those related to cognitive development. The child will thus pass from isolated play, which is used to explore one’s own person or objects in the surrounding environment, to joint play, which is performed with a partner (this transition is preceded by a stage aimed at observing the others’ play). During the communion play, the child not only intervenes in the others’ play, but also accepts in turn the intrusion of the other children into his/her own play. Here are the first signs announcing the emergence of social play, which becomes frequent in the child’s play repertoire during the preschool period and commonly involves both cooperation and competition, two extremely important social skills.

The desire to have a safe and available partner whenever the game played requires a second participant will stimulate the emergence of the first forms of friendship during the mentioned period. By interrelating, children learn the meaning of trusting the other and the intimacy that this trust makes possible, as well as the behaviours needed to express it. The quality of these early forms of social play mostly has a predictive value, the child’s ability to make close friends in the preschool period being a good indicator of their success in establishing friendship relations in the school period. The importance of friendship relations is considerable, because they ensure participation in complex social games played in this period, those true “social dramas” in which age-matched children exercise their negotiation and collaboration skills and learn the norms and customs of the culture to which they belong.

The situation of a child unable to join the others’ play or attract the other children to one’s own play is equivalent to the situation of a country whose national currency is not convertible to foreign currency and consequently is condemned to isolation. The autistic child is somewhat in the same situation: play is important to him/her as well, but has its own forms that are not understood, appreciated and accepted by the other children. Similarly, playing with age-matched children is not interesting for the autistic child. The two worlds do not meet, and the consequences are dramatically unfavourable for the autistic child. One of the effects is that the autistic child very rarely succeeds in making friends by themselves. Although not inexistent, friendship relations between autistic children and those with normal development are strongly dependent on adult mediation and generally are less stable (Bauminger & Shulman, 2003).

Topic addressed

In the first year of life, children’s play is usually confused, even identified with their exploration activities. From this perspective, their toys are true tools of knowledge. The colour, texture, taste and smell of different toys are unconsciously explored when the baby introduces toys into his/her mouth, waves them in front of his/her eyes, hits, smells or throws them. Until around the age of 8 months, the infant is especially interested in what a
particular object can do alone. Then, around the age of 12 months, the baby is curious to find out what two objects can do together. An intense and sustained sensory-motor (instrumental) activity is performed in order to find out as much as possible about the surrounding world. However, play and toys are not only instruments to explore the surrounding world, but also ways of exploring and testing one’s own physical and mental abilities, a kind of “self-testing behaviour” by which the child becomes aware of both his/her qualities, potential and limitations.

Although relatively rudimentary, the early forms of play are not without importance in identifying deviations that a possible autistic pathology might induce. Usually, autistic babies are intensely preoccupied, for abnormally long periods, with examining one and the same object or a single part of an object (Williams et al., 2001). Generally, they have certain preferred exploratory patterns in which proximal senses are preponderantly involved, namely the touch, smell, taste and less the visual analyser. Oral exploration of objects, which is normal up to a certain age, is preferred for investigating the unknown even at school age, especially by children diagnosed with low-functioning autism. However, there are studies that quite frequently identify this pattern of object analysis by smelling and oral exploration in high-functioning autistic people too. In situations where autistic children also perform a visual analysis of objects, this is atypical because it takes place in a strange way, namely by passing them quickly and repeatedly before the eyes, at small distances from the child’s face.

Differences in play during the first year of life are not only qualitative. The normally developing child gradually replaces undifferentiated exploration forms consisting in the simple manipulation of objects with more complex modalities specific to relational play, which involve the use of two or more objects. This is not the case for autistic children: they remain blocked in a first stage of undifferentiated exploration for much longer than their mental age would allow. Subsequently, when they appear, games that involve relating two objects are less frequent by far compared to the norm. However, differences between autistic children and those with normal development become increasingly obvious with the transition to a higher form of play, which is pretend or imaginative play.

For the normally developing child, this form of play appears around the age 1 year, and the typical objects used can be a teaspoon, a phone or a doll. In general, the child imagines situations such as drinking a liquid from an imaginary mug, making a phone call to an imaginary person, etc. It is difficult to say with certainty to what extent these actions are really symbolic acts and to what extent they represent acts that imitate what the adult or another child has previously done with the aforementioned objects (Muraru-Cernomazu, 2004).

Things become much clearer only after the middle of the second year of life, when the child’s pretend activities become more complex, involving symbolic patterns whose components have been previously acquired. These typical symbolic acts are produced in different contexts: either the same symbolic act that involves relating several objects (the child introduces the teaspoon into the mug, and then into the sugar bowl) or different interconnected acts that are performed sequentially (the child pours from the sugar bowl into the mug, and then “sips” from the mug) (Bretherton, 1984).

Over time, until the age of 3 years, the child becomes able to give up the material supports indispensable for building their own imaginary world until around the age of 12 months. During this period, the child’s ability to imagine is expressed by what is referred to in the literature as “functional play” (Baron-Cohen, 1987).

According to Ungerer & Sigman (1981, p. 320), “functional play involves the proper use of an object or the conventional association of two or more objects such as a teaspoon to feed a doll”.

With the end of the second year of life, a cognitive event that will deeply mark the child’s subsequent evolution occurs: the meaning comes to dominate over appearances, as noted by Vygotsky, or in Piaget’s terms, the significance of the present action or object begins to clearly separate from what the absent object or action symbolises. Thus, a banana placed next to the ear may suggest a phone, a pencil may be a rocket, etc. Many experts claim that only from this moment one can talk about the emergence of symbolic play as a result of the mediation that the child’s imagination makes between sensation and perception. Unlike the previous form, namely functional play, this one involves the existence of a complex system de representations, which includes not only first-order representations (such as the one due to which a pencil can be regarded as a rocket), but also a second-order representation called “meta-representation” that equally aims at the first-order ones and due to which the child pretends, during the symbolic play, that something is something else, while being aware of the absurdity of the act carried out. Thus, an important differentiation is made between symbolic play and functional play, during which the child is seriously engaged in play activities, the imaginary component of his/her actions being obvious only to the observer.

Sensory-motor intelligence, which is mainly responsible for play acts, still remains the essential support of the child’s activity. The child becomes able, with the emergence of symbolic play, to establish not only immediate physical relations but also symbolic relations between objects. With the maturation of intellectual functions and the acquisition of social experience, the child will attribute imaginary properties or qualities to an object (the doll
is sick, the car can fly, etc.), and then will pretend the existence of an absent object (driving a car on an imaginary street) (Libby et al., 1998).

The mental ability to pretend, regardless whether it is about the simple forms of functional play or the more complex forms of symbolic play, involves completing several cognitive stages, which was first observed and described by Piaget. Broadly, these stages are: decontextualisation, which allows play to be produced independently of the support provided by the environment; decentration, due to which symbolic actions become independent of one’s own body (which allows the use of dolls or the others’ bodies for the actions imagined while playing, but also the understanding and acceptance of the others’ symbolic actions); integration, through which the child synchronises the acts of functional play into coordinated behavioural sequences, which will subsequently lead to the emergence of sequential play, whose organization is complex (Williams et al., 1999).

Regarding autistic children, although there are studies that attest the existence of spontaneous functional and sometimes symbolic acts of play (Ungerer & Sigman, 1981), one can identify, in their play repertoire, numerous differences in the weight, frequency and quality of these acts, as compared to what is considered normal. There are different opinions about the form of imaginative play used: some believe that it is only the purely symbolic one, other also include functional play.

When identifiable, the acts of autistic children’s functional play are exclusively directed towards objects or their own person and only rarely are aimed at another person or a substitute of this person. In the case of imaginative play, as well as exploratory play, the differences compared to normally developing children are related to both the qualitative and quantitative aspects. Thus, if a child with normal development, who is already capable to get involved in higher forms of play, prefers to engage for longer in performing them to the detriment of less evolved forms, the autistic child evenly distributes his/her play time between the mature forms of play, such as imaginative play, and the immature ones, such as sensorimotor exploration, which does not consider the functionality of an object, finally preferring the immature forms of play (Libby et al., 1998).

Conclusions

Numerous studies have analysed the particularities of autistic children’s play, although they are sometimes objectionable from a methodological perspective (Jarrold, 1993). The first researchers interested in this topic were Tilton and Ottinger, who published, in 1964, a study that aimed to compare the play repertoire and the toys used by a group of autistic children with those of an age-matched group made up of mentally retarded children. The two authors concluded that, in the autistic group, an oral pattern of toy exploration was predominant, while spontaneous play acts were less frequent and had a stereotype character, the investigated children rarely using the combination of different play patterns.

In 1981, Ungerer and Sigman analysed the play of 16 autistic children, initially in an unstructured framework, and then in a structured one, tracking the effects of the environment on the quality of autistic children’s play, as well as the correlations between the quality of language and play in the investigated subjects. The results showed a clear improvement in the quality and diversity of autistic children’s play in structured conditions, but also a close correlation between the level of language development and the number of performed imaginative play acts.

Naturally, after identifying and accepting the pathology of autistic children’s play, experts tried to elucidate the causes leading to its emergence. Proponents of the theory according to which the differences between autistic children and those with normal development are visible only in their symbolic play have searched for a solution to this problem in the analysis of cognitive impairments specific to autistic pathology. Those admitting that not only symbolic play, but also functional play, which appears earlier in the child’s development, have specific features, will try to identify the causes of this situation by investigating the socialisation problems of autistic people.

In this regard, the first theories were related to the cognitive functioning impairments of the autistic child. In order to formulate them, researchers started from observing a specific autistic deficit in symbol formation. Minutely described in the study conducted by Ricks and Wing (1975), the difficulties in forming and manipulating symbols were included (with the emergence of the famous theory of mind issued by Baron-Cohen in 1987) into the category of broader cognitive deficits specific to autistic people, which make them unable to process meta-representations. They are thought to be absolutely indispensable cognitive processes in the emergence of symbolic play and subsequently in the development of a theory of mind (the ability to understand the other’s inner life in its whole complexity).

A later theory assumes these considerations, stating that not necessarily the lack of ability to form meta-representations, but rather the delay in their development would underlie the disruptions existing in autistic children’s play. However, observing some disorders in the design and development of functional play (which does
not involve the existence of meta-representations), perceiving an improved quality in autistic children’s play in structured situations and especially describing numerous cases in which autistic children were able to spontaneously produce acts of symbolic play represented as many challenges to which the above-mentioned hypothesis could not answer. Therefore, the attention of many researchers turned to another deficit specific to autistic pathology, namely the communication and socialisation deficit.

Insofar as the communication of autistic children with the other members of the social group is poor, it is predictable that anything this relation is supposed to bring will also be affected. Because the “familiarisation” of the child with the environment, namely the presentation of the purpose and the proper use of its objects, is mostly achieved by adults or the other children, autistic people, unable to properly exploit the relationships, are expected to fail to make a correct picture of how the surrounding objects work or are used. As play schematises, imitates just the real world, it is obvious that a different, fragmented understanding of this world, and especially of one’s own self in relation to it, may cause the emergence of abnormal play patterns (Williams et al., 2001).

The results of the study published by Williams, Costall and Reddy in 1999 have revealed a different point of view that takes into account the functional play deficit of autistic children and the problems they encounter not only in establishing relationships with other members of the social group, but also relationships with the objects of the material world in which they live. Therefore, autistic children have problems not only with people, but also with objects, which they use in a strange way, often stereotypically and repetitively, and that is because they do not properly understand their meaning and “canonical” use. The main responsible for these anomalies is thought to be a socialisation deficit, which prevents autistic people from “learning” from others about the meaning and use of the things they encounter everyday (Williams et al., 1999).

Most of the above theories start from claiming the existence of disturbances in the acquisition of functional patterns necessary for daily living.

Another interesting hypothesis refers to the existence of a deficit in the central executive control, which is equally responsible for the repetitive, stereotype ritual behaviour of autistic children. According to this theory, the immediate physical reality is more easily accessible, in cognitive terms, to autistic people than mental reality. For this reason, the transition from actions determined by a certain external context to those internally, mentally determined is very difficult. It is not necessarily about the lack of will, but rather about a compulsive deficit in imposing it, which makes it impossible to switch from habitual manipulative activities to creative activities in which one’s own reason takes control over the sensations determined by the physical world. This theory is related to the generative impairment theory, which claims the existence of difficulties in both generating internal, mental representations and accessing the previously stored information, which would cause the deficit of creativity and originality specific to autistic people.

Unlike the meta-representational theories, both the executive control theory and the generative deficit theory satisfactorily explain not only the functional and symbolic play defects, but also the fact that they tend to fade in structured situations. They seem to be much more appropriate for explaining the problems of autistic people described by Gould (1986) as “a small group of people with socialisation problems, with scores within the normal range at the standardised intelligence tests, able to build relatively complex symbolic concepts, but unable to manipulate them correspondingly”.

The imaginative play deficit certainly exists in the autistic child, although its causes are unclear. The consequences are identifiable on multiple levels and contribute both implicitly and explicitly to establishing the symptomatology of this disease.

Authors’ Contributions

All authors contributed equally to this study and should be considered as main authors.

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OPTIMISING TECHNICAL SHOOTING SKILLS AT THE SHOOTING RANGE BY ADJUSTING THE INTENSITY OF THE EFFORT TO JUNIOR BIATHLETES

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Abstract. Performance benefits today, in all sports branches, from a quick evolution, which is determined, according to the unanimous opinion of specialists, by the continuous improvement of methods and means aimed at optimising motor skills and as well as the process of developing their targeting in the smallest details. The essential objectives and tasks of the performance and high-performance biathlon in our country for the next period can only be achieved if the training methodology is properly guided and scientifically substantiated. The aim of the research is to identify ways to reach the exercise capacity specific to biathlon so as to facilitate the achievement of an optimum biological condition needed for efficient range shooting. In the experimental research, we aim at the psychomotor condition manifested by the stability of corroborative coordination abilities obtained through individualised proprioceptive training and the adjustment of heart rate before the activity at the shooting range. As a result of the scientific research, we can say that the working hypothesis has been confirmed. Thus, through individualised proprioceptive training and the guided adjustment of heart rate that leads to the adjustment of exercise intensity, we can optimise the technical ability to shoot at the range in the junior biathlon event.

Keywords: biathlon ski, proprioceptive training, heart rate, effective shooting.

Introduction

Performance benefits today, in all sports branches, from a quick evolution, which is determined, according to the unanimous opinion of specialists, by the continuous improvement of methods and means aimed at optimising motor skills, as well as the process of developing their targeting in the smallest details. (Pelin, Turcu, & Tohânean, 2008).

The essential objectives and tasks of the performance and high-performance biathlon in our country for the next period can only be achieved if the training methodology is properly guided and scientifically substantiated.

Achieving this qualitative leap is not possible without paying attention during the training to the following aspects (Pelin, Pelin, & Arghiropol, 2008, p. 72):

- continuous modernisation of the training process, knowledge and application of the latest breakthroughs of theory and practice;
- compliance with the workload at world parameters including 1300-1400 hours of training, 8000-10000 km, 9000-11000 cartridges per year for a high-performance athlete.

Maximum performance in sport, so also in biathlon, can be achieved only by those athletes who have a specific biological background.

According to Pelin, Pelin and Lungociu (2007 p. 45), the psychomotor qualities that a performance biathlete must possess are:

- good cardiorespiratory endurance achieved by maximum oxygen consumption of at least 75 O$_2$/kg body and anaerobic capacity exceeding 45 kgm/kg body;
- very good local muscle endurance of the lower limbs and shoulder girdle;
- very good general skill, in which the main role is played by the sense of balance and coordination;
- good speed of reaction and execution, good vertical jump, correct estimation of distances and good orientation in space.

Shooting training

According to Pelin and Mereuță (2018), the training for the shooting technique is divided into two parts:
1. Ammunition-free weapon training
2. Technical training in conditions of effort

The basic learning, improvement and maintenance of the shooting technique are carried out by simulated “tube” shooting throughout the year.

Neglecting “tube” shooting reduces control of the following factors:

- weapon-body complex;
- eye-finger reflex;
- target-trigger connection.
After specific training (competition, etc.), biathlon athletes resume the extensive “tube” training. Each training session or competition must be analysed in its good and bad aspects, and the new experience must be combined with the old one. The measuring mechanisms (archery technique) change and may decrease efficiency; for this, they must be closely watched in the competition season.

An insufficiently stable movement mechanism due to improper training cannot be effective in terms of intense effort during the competition.

Breathing technique and proprioceptive training in junior biathletes

In biathlon shooting, breathing should be focused on interrupting the increased cardiac frequency during targeting, which is caused by prior physical effort. The quality of the breathing technique is obtained through the uniformity of the shooting intervals, a balanced rhythm (succession between inspiration, expiration and apnoea), as well as appropriate coordination with the other elements of the technique (Bondoc-Ionescu, 2017, p. 33).

When shooting as part of the biathlon, the breathing technique is a component of the level of sensory-motor adjustment.

In the experimental research, we aim at the psychomotor condition manifested by the stability of corroborative coordination abilities obtained through individualised proprioceptive training and the adjustment of cardiac frequency before the activity at the shooting range.

The visual analyser is primordial in the route orientation and helps in the formation of spatial-temporal orientation due to the fact that the route has bumps that require using the kinaesthetic differentiation and balance abilities through careful and differentiated control of the spatial-temporal dynamic parameters of the event-specific movements (Teodorescu, 1989, p. 15).

The ability to adopt different rhythms in relation to space and time is very important and is conditioned by various muscular interventions mostly formed through proprioceptive training (Bondoc-Ionescu, 2017, p. 35).

The coordination ability to transform movements involves the breathing rhythm, limb frequency and the tactics agreed with the coach, the departure rhythm – changes in rhythm during the event depending on both the bumps encountered and the quality of the snow, which involve the tactile sense of slipping, as well as the surrounding environment.

According to Bondoc-Ionescu (2017 p. 36), the presence at and accommodation with the range refer to the coordination ability of combining and coupling specific movements, due to the fact that the athlete uses breathing regulation, the coordination ability of kinaesthetic balance, the coordination of weapon handling and centralised spatial-visual control over the range target. By training the optical analyser, we manage to set and control the image, the target in the range, which, through long exercise, leads to the quick preparation of the shooting position and shooting performance.

The tactile analyser has a special role in getting used to the weapon, its shape and weight, as well as the action on the trigger, because it must be handled slowly, without jerking, in order not to divert the trajectory of the bullet.

We note that, on the route, due to the narrow contact surface of the ski with the snow, the kinaesthetic sense and the strength skill have an important role in maintaining balance, along with the vestibular and visual skills (Pelin & Pelin, 2018).

According to Dragnea (1996, p. 133) and Bompa (2001, p. 203), the acoustic analyser is important because the auditory information intervenes as an additional element in the movement, due to the environment and the opponent. Auditory control is required for route communication with the coach, teammates, or referees; this leads to making optimal action decisions and anticipating the route in the variable conditions of climate, wind, thick snow, snow quality, all of this requiring orientation and coordination ability, adaptation and transformation of the motor act.

The quality of motor coordination during the competition depends on the individual’s physical ability and preparedness to cope with fatigue in a long-standing effort regime, especially since the athlete needs to focus on the range to properly fix the visual image and accurately perform the shooting so as it does not negatively influence the result (Pelin & Balint, 2019, p. 403).

Material and methods

Participants

The investigated group was made up of 8 junior athletes (5 boys and 3 girls) aged 17-19 years in the performance group of the Dinamo Râșnov School Sports Club (CSS). The 8 juniors were included in the
experimental program based on the agreement and recommendations of the club’s coaches Gheorghe Pelin and Gheorghe Gărbacea.

Procedure

The experimental research was conducted between 03.01.2019 and 01.03.2019. The research site was the Training Centre of the Dinamo Râșnov School Sports Club located in Valea Cârbanului.

Prior to the start of the experiment, the 8 athletes were tested at the Olympic Testing and Scientific Assistance Centre, where they performed, along with the national team, several tests for their resting metabolic rate and VO2max (Table 1).

Direct observation, based on observation lists, allowed us to record the data obtained by the subjects at the beginning and the end of the period. This was carried out following a thematic plan aimed at objectifying the collected results.

The observation sheets were prepared so as to allow the quantitative and qualitative data processing and contained:
1. identity data
   - time: 03.01.2019-01.03.2019;
   - place: Valea Cârbanului Training Centre;
2. recorded values:
   - resting metabolic rate and VO2max;
   - heart rate at the range entry;
   - shooting in the prone position;
   - shooting in the standing position.

Results

A set of tests (the ones listed above) were used to conduct the experiment. They were performed once at the beginning of the period – 02.12.2018 (without knowing the heart rate) and then at the end of the period – 02.02.2019 (knowing the heart rate). Each tested athlete ran 10 km making 4 shots. Heart rate was recorded using pulse-testers and the efficiency of the shooting line was followed. During this period, the experimental group attended each training session scheduled by the club’s coaches (5 sessions per week) and worked more on the shooting technique at the range, along with the proprioceptive training adapted to biathlon.

Table 1. Test results for the resting metabolic rate and VO2max

<table>
<thead>
<tr>
<th>Name initials</th>
<th>VO2max</th>
<th>VO2/L</th>
<th>HRmax</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. P.C.</td>
<td>71.6</td>
<td>5.1</td>
<td>200</td>
<td>120-144</td>
<td>144-164</td>
<td>164-174</td>
<td>176-184</td>
<td>186-200</td>
</tr>
<tr>
<td>4. F.R.</td>
<td>63.8</td>
<td>4.8</td>
<td>210</td>
<td>126-151</td>
<td>151-172</td>
<td>172-182</td>
<td>185-193</td>
<td>195-210</td>
</tr>
<tr>
<td>5. B.F.</td>
<td>62.6</td>
<td>3.7</td>
<td>199</td>
<td>119-143</td>
<td>143-163</td>
<td>163-173</td>
<td>175-183</td>
<td>185-199</td>
</tr>
<tr>
<td>6. D.A.</td>
<td>62.3</td>
<td>4.2</td>
<td>196</td>
<td>118-141</td>
<td>141-161</td>
<td>161-171</td>
<td>172-180</td>
<td>182-196</td>
</tr>
<tr>
<td>7. C.L.</td>
<td>59.4</td>
<td>2.9</td>
<td>209</td>
<td>125-150</td>
<td>150-171</td>
<td>171-182</td>
<td>184-192</td>
<td>194-209</td>
</tr>
</tbody>
</table>
Table 2. Initial testing – Without adjusting heart rate before entering the shooting range

<table>
<thead>
<tr>
<th>Name initials/ Gender</th>
<th>HR Entry 1</th>
<th>HR Entry 2</th>
<th>HR Entry 3</th>
<th>HR Entry 4</th>
<th>Shooting P</th>
<th>Shooting S</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. B.G. - male</td>
<td>164</td>
<td>171</td>
<td>182</td>
<td>191</td>
<td>1-2</td>
<td>1-2</td>
</tr>
<tr>
<td>2. P.C. - male</td>
<td>170</td>
<td>175</td>
<td>188</td>
<td>200</td>
<td>2-1</td>
<td>3-1</td>
</tr>
<tr>
<td>3. D.S. - male</td>
<td>157</td>
<td>168</td>
<td>190</td>
<td>202</td>
<td>2-2</td>
<td>1-4</td>
</tr>
<tr>
<td>4. F.R. - male</td>
<td>164</td>
<td>170</td>
<td>188</td>
<td>205</td>
<td>0-3</td>
<td>1-2</td>
</tr>
<tr>
<td>5. B.F. - male</td>
<td>158</td>
<td>167</td>
<td>183</td>
<td>198</td>
<td>2-3</td>
<td>1-1</td>
</tr>
<tr>
<td>6. D.A. - female</td>
<td>171</td>
<td>177</td>
<td>185</td>
<td>194</td>
<td>2-1</td>
<td>2-3</td>
</tr>
<tr>
<td>7. C.L. - female</td>
<td>165</td>
<td>171</td>
<td>188</td>
<td>203</td>
<td>1-4</td>
<td>1-2</td>
</tr>
<tr>
<td>8. T.H. - female</td>
<td>163</td>
<td>170</td>
<td>187</td>
<td>200</td>
<td>2-2</td>
<td>3-3</td>
</tr>
</tbody>
</table>

Shooting efficiency
Arithmetic mean 164 171.12 186.37 199.12

Legend: HR – heart rate; P – prone; S – standing

Table 3. Final testing – By adjusting heart rate before entering the shooting range

<table>
<thead>
<tr>
<th>Name initials/ Gender</th>
<th>HR Entry 1</th>
<th>HR Entry 2</th>
<th>HR Entry 3</th>
<th>HR Entry 4</th>
<th>Shooting P</th>
<th>Shooting S</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. B.G. - male</td>
<td>158</td>
<td>163</td>
<td>170</td>
<td>177</td>
<td>1-0</td>
<td>1-1</td>
</tr>
<tr>
<td>2. P.C. - male</td>
<td>163</td>
<td>169</td>
<td>175</td>
<td>182</td>
<td>0-1</td>
<td>1-1</td>
</tr>
<tr>
<td>3. D.S. - male</td>
<td>151</td>
<td>157</td>
<td>168</td>
<td>180</td>
<td>1-1</td>
<td>2-0</td>
</tr>
<tr>
<td>4. F.R. - male</td>
<td>160</td>
<td>164</td>
<td>178</td>
<td>191</td>
<td>0-1</td>
<td>0-2</td>
</tr>
<tr>
<td>5. B.F. - male</td>
<td>155</td>
<td>161</td>
<td>172</td>
<td>188</td>
<td>1-2</td>
<td>1-1</td>
</tr>
<tr>
<td>6. D.A. - female</td>
<td>166</td>
<td>168</td>
<td>177</td>
<td>183</td>
<td>1-0</td>
<td>1-1</td>
</tr>
<tr>
<td>7. C.L. - female</td>
<td>160</td>
<td>165</td>
<td>180</td>
<td>189</td>
<td>0-2</td>
<td>1-1</td>
</tr>
<tr>
<td>8. T.H. – female</td>
<td>155</td>
<td>159</td>
<td>169</td>
<td>185</td>
<td>0-2</td>
<td>1-1</td>
</tr>
</tbody>
</table>

Shooting efficiency
Arithmetic mean 158.5 163.25 173.62 184.37

Legend: HR – heart rate; P – prone; S – standing

As we can see from Table 2 and Table 3, the shooting efficiency is higher for junior biathletes when they adjust their heart rate before entering the shooting range (the initial value for the prone position is 62.5% compared to the final value of 83.75% efficiency, and 61.25% compared to 80% for the standing position).

Conclusions
Following the experimental research, it was found that the parameters recorded in initial testing and final testing had undergone relevant changes in the heart rate recorded at the range entry and at exit.

We can conclude that a repetition of the specific shooting acts at the biathlon range is due to the improvement of coordination abilities (spatial-temporal, kinaesthetic sense of balance and shooting rhythm) that contribute to improving the technical shooting skills at the range.

Also, by adjusting heart rate before entering the range area, we obtained efficiency and progress in shooting from both the supine and standing positions.

References
Pelin, B. I., & Balint, G. H. (2019). Improvement of endurance in preparing the biathlon ski tests through means specific to athletics at junior II level. FIEP BULLETIN, 89(Special Edition), 402-406.
INCREASING THE MOTIVATION OF CHILDREN TO PRACTICE BASKETBALL BY IMPLEMENTING THE “FAIR-PLAY” CUP-TYPE COMPETITIVE MANAGEMENT

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Abstract. This paper is intended to highlight the role of the managerial activity in order to increase the motivation of children for practicing basketball through “Fair-Play” Cup-type competitions. Starting from the premise that both coaches and athletes will cooperate, this research aims to assess the motivation level of athletes and to see whether a change in the managerial vision will influence their motivation to practice this sport. The study was carried out at the School Sports Club no. 6 in Bucharest, with 12 children (boys) aged 10 to 11 years, Mini Basketball category. A number of 6 teams – each one including 12 children – participated in the “Fair-Play” Cup. The motivation level of the children was assessed by means of a 14-item questionnaire monitoring how the different types of motivation enhanced the subjects’ work for increasing their performance. Targeted indices: Intrinsic Motivation Index (IMI) and Extrinsic Motivation Index (EMI). The statistical analysis was made using the KyPlot program for the descriptive data and the parametric t-test for Paired Samples. The statistical data results for the IMI show an increase with 0.62 points (5.75; ± 0.59 points) and significant differences at p < 0.001; as for the EMI – an increase with 0.57 points (5.86; ± 0.69 points) and significant differences at p < 0.001. At the end of the study, we conclude that the efficient use of managerial activities in organizing and conducting “Fair-Play”-type competitions for children has contributed to increasing motivation for practicing basketball at this level.

Keywords: competition management, mini basketball, baby basketball, regulations, performance.

Introduction

Basketball is included in the notion of collective sports games. As a sport, basketball – practiced in an organized and systematic way – determines a harmonious physical development, ensures an optimal influence on the great functions of the body and has a positive contribution to the development of motor abilities and basic motor skills. The basketball game, due to its educational values, is an efficient game for sports culture and education, being available to those who practice it as a performance sport and those who practice it as means of recreation. It demands and develops the entire body equally, through its rich motor content and large variety of movements that reach virtuosity manifested in ball handling in various conditions of balance and adversity. The predominance of the technical demands leads to accumulations and manifest a fruitful activity and physical exercise, in which athletes – forming two teams, each one of five players – are temporarily in a tacit adverse relationship (typical for sports games) called sports rivalry and compete on a field specially arranged with basketball hoops in order to win the victory, each one trying to make several successful throws in the basketball hoop of the opponents by handling the ball in compliance with the rules of the game (Predescu, 1999). The current high level of basketball practice has been reached due to the process of learning and improving the game technique and tactics. The factors that, together with the material conditions, constitute the prerequisites for a fruitful activity are the initiation into the secrets of the game from an early age, on the one hand, and the identification of the most appropriate ways and means, on the other hand (Ghițescu & Moanță, 2013). The main features of the basketball game in school are based on the idea that basketball is the sports game that can be practiced by children and young people of both genders and even by elderly people for competitive purposes, but also as a recreational (fitness-related or playful) physical activity (Hrişcă, Predescu & Negulescu, 1987). The basketball game involves and develops to the same extent the whole complex of biomotor (conditional and coordination) skills due to its large motor content and the great number of diverse movements required (Anastasiadis, 2006).
The activity of physical education and sport, through its formative valences, is a good socialisation environment for students, because, at this age, their integration into a complex association (classroom, group, team) develops their personality in all aspects, helping them to better integrate into society (Ghițescu & Moaș, 2015). The reform of the educational system in Romania has generated conceptual, methodological and organizational changes in the Physical Education and Sport subject, as well as other school subjects. The tendency to practice the physical exercise in the form of games and competitions is supported by the beneficial effects of introducing the dynamic, training or sports game in the Physical Education lesson in order to develop the personality of the children and faster integrate them into society (Popescu & Porfireanu, 2003).

Mini basketball is the game that can be practiced by children, both boys and girls. Essentially, it is a modification of the adult game that has been adapted to the needs of the children. The target of the mini basketball is to provide children, regardless of their abilities, with opportunities to show their skills, to enjoy rich and positive experiences, ensuring their enthusiastic transition to playing the basketball game. Teachers and coaches have the responsibility to gradually introduce the rules of the game in accordance with the development of the children. Thus, the game can be practiced in several forms: 1 x 1, 2 x 2 on an improvised but safe surface, on a playground outdoors, probably at a basketball hook fixed on an outside wall or in the gym; 3 x 3 in the form of a training game in schools or gyms; games between two schools or clubs; local or regional competitions joining together several teams from a geographic area; exhibition games between selected teams on the occasion of international events; national championships (“Asociația Municipală Baschet București”, 2019).

The management implemented in sport contributes to achieving the full functionality of the sports structures, large masses of people, a multitude of means and skills, objectives and intentions (Gentile, 2010, p. 122). The particularities of sports management also lie in the fact that it is applied to all forms of sports activities and all sports disciplines, which ensures organized participation that leads to the achievement of superior results in sports competitions. An essential feature of the sport is the competition, the contest between individuals or teams to win, to get the best possible result and achieve the most valuable performance. All contests and competitions organized on the basis of certain principles that aim at achieving the purposes and objectives of physical education and sport represent the competition system. One of the most important activities of sports managers is related to the organization of sports competitions (Lussier & Kimball, 2009, p. 37).

In order to organize a sports competition, it is necessary to draw up a regulation of its own, specifying the organizational, administrative and technical conditions, in addition to the technical regulations of each sports discipline. The wide range of sports and events entails the existence of several types of sports competitions (Manolescu, 2001, p. 77). The way of appreciating the results is also diverse. Especially in sports games, the competitions are organized in an “each-to-each” system. As can be seen from the examples above, there are several competition systems in sports. The most commonly used are the following two: the elimination system and the tournament system (Dragoş, 2014).

Approaches to understanding the concept of motivation differ, because many theorists have been concerned with this problem. For example, the literature provides a number of definitions for the concept of motivation (Epuran & Horghidan, 1997); also, regarding the characteristics of each type of motivation, they are presented in pairs, with opposite components (Dănciua, Bibu, & Predișcan, 2002). Sports education concerns the ability of both the athlete and spectator (appreciating the aesthetics of the motor act, knowing the regulation and fair-play behaviour). Nowadays, the motivation for sport permanently acts on us through the multiple and various means of the media (Voicu, 1998).

The purpose of the paper is to highlight the role of the managerial activity in increasing the motivation of children for practicing basketball in “Fair-Play” Cup competitions.

Hypothesis of the paper. We believe that the efficient use of managerial activities in organizing and conducting “Fair-Play”-type competitions for children will contribute to increasing motivation for practicing basketball at this level.

Starting from the premise that both coaches and athletes will cooperate, this research aims to assess the motivation level of athletes and to see whether a change in the managerial vision will influence their motivation to practice this sport.
Material and methods

Participants

The study involved 12 children (boys) aged 10 to 11 years, Mini Basket category, teacher S.M.

Instruments

The assessment of children’s motivation to practice basketball was made using a 14-item questionnaire (after Colibaba-Evuleţ & Doba, 2008) focused on how different types of motivation enhance the work of the subjects in order to increase their performance. The assessment was based on a scale from 1 to 7: strongly agree - 7, agree - 6, partially agree - 5, do not know - 4, slightly disagree - 3, disagree - 2, and strongly disagree - 1.

Monitored indices: intrinsic motivation index (IMI) and extrinsic motivation index (EMI).

Calculation of motivation indices: IMI of athletes: \( \sum \frac{5,6,7,9,10,12,13}{7} \); EMI of athletes: \( \sum \frac{1,2,3,4,8,11,14,17}{7} \), where \( \sum \) - sum of items, “/” - division.

Procedure

The research was conducted at the School Sports Club no. 6 (CSS6) in Bucharest. Six teams entered the competition: 4 teams from CSS6 and 2 invited teams – CSO Voluntari and Next Star. Each team was formed of 12 children.

The games took place without displaying the score; size of the ball: no. 5; playing time: 4 quarters x 10 min, warm-up 5 min / main time out 5 min, 1 time out x 1 min / game, continuous playing time, without stopping the timer. Team formed of 12 players with game regulation in the first two quarters 5 + 1 / game quarter (“Asociația Municipală Baschet București”, 2019).

The “Fair-Play” Cup for children aged 10 to 11 years – Mini Basket was held from 08 to 10.02.2018 in the CSS6 gym. Schedule (Table 1):

Table 1. Schedule of the “Fair-Play” Cup

<table>
<thead>
<tr>
<th>Time</th>
<th>1st day – 08.02.2018</th>
<th>2nd day – 09.02.2018</th>
<th>3rd day – 10.02.2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.00</td>
<td>CSS6 (1) - CSO Voluntari</td>
<td>CSS6 (3) - CSS6 (2)</td>
<td>CSO Voluntari - CSS6 (2)</td>
</tr>
<tr>
<td>11.00</td>
<td>CSS6 (2) - Next Star</td>
<td>CSS6 (1) - CSS6 (4)</td>
<td>CSS6 (2) - CSS6 (3)</td>
</tr>
<tr>
<td>12.00</td>
<td>CSS6 (3) - CSS6 (4)</td>
<td>CSO Voluntari - Next Star</td>
<td>CSS6 (4) - Next Star</td>
</tr>
<tr>
<td>13.00</td>
<td>CSO Voluntari - CSS6 (3)</td>
<td>CSS6 (1) - CSS6 (2)</td>
<td></td>
</tr>
<tr>
<td>14.00</td>
<td>CSS6 (2) - CSS6 (4)</td>
<td>CSS6 (3) - Next Star</td>
<td></td>
</tr>
<tr>
<td>15.00</td>
<td>Next Star - CSS6 (1)</td>
<td>CSS6 (4) - CSO Voluntari</td>
<td></td>
</tr>
</tbody>
</table>

Time: 13:00, Award ceremony

Results

The statistical indices were calculated by means of the KyPlot program for the descriptive analysis of the mean, standard deviation (± SD), coefficient of variation (Cv%) and parametric t-test for Paired Samples.

Table 2 presents the results of the assessment of children’s motivation indices in initial and final testing for the intrinsic motivation index and the extrinsic motivation index.

Table 2. Results of the motivation indices of athletes (n =12)

<table>
<thead>
<tr>
<th>Indices</th>
<th>Index of intrinsic motivation</th>
<th>Index of extrinsic motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial testing</td>
<td>Final testing</td>
</tr>
<tr>
<td>mean</td>
<td>5.13</td>
<td>5.75</td>
</tr>
<tr>
<td>± SD</td>
<td>0.76</td>
<td>0.59</td>
</tr>
<tr>
<td>Cv%</td>
<td>14.79</td>
<td>10.27</td>
</tr>
<tr>
<td>min</td>
<td>4.57</td>
<td>5.28</td>
</tr>
<tr>
<td>max</td>
<td>6.43</td>
<td>6.71</td>
</tr>
<tr>
<td>t</td>
<td>-10.79</td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

Note: SD – standard deviation, Cv – coefficient of variation, t – parametric test
The results of the statistical calculations for the intrinsic motivation index in initial testing show a mean of 5.13; ± 0.76 points (partially agree), moderate homogeneity CV – 14.79% and interval of item values (IMI) of 4.57 – 6.43 points. In final testing, we notice an increase in IMI by 0.62 points (5.75; ± 0.59 points), the improvement of homogeneity CV – 10.27% and interval limits 5.28 – 6.71 points. The comparative analysis of the means between tests highlights significant differences at p < 0.001.

The results for the extrinsic motivation index in initial testing show a mean of 5.29; ± 0.84 points (partially agree), moderate homogeneity CV – 15.85% and interval of item values (EMI) of 4.71 – 6.43 points. In final testing, there is an increase in EMI by 0.57 points (5.86; ± 0.69 points), an improved homogeneity CV – 11.73% and improved limits of EMI interval 5.28 – 6.85 points. The comparative analysis of the means between tests shows significant differences at p < 0.001.

Discussions and conclusions

The results of the research highlight the “Fair-Play” competition organized by the teachers of the School Sports Club no. 6 in Bucharest. A number of 6 teams participated in this competition that lasted three days – tournament system – during which each team played two matches per day. The competition was held for the age category with the birth year 2007-2008 (Men’s Mini Basket). The score was not displayed during these games. Playing time: 4 quarters x 10 min, warm-up 5 min / main time out 5 min, 1 time out (TO) x 1 min / game, continuous playing time, without stopping the timer. The team included 12 players with game regulation in the first two quarters 5 + 1/ game quarter. At the end of the competition, all children received medals, diplomas and cups (Figure 1).

Figure 1. Award ceremony (diplomas, medals and cups)

Following the assessment of the intrinsic motivation index, it has been observed that the teacher/coach can influence the children’s feelings, because they like to see that their abilities and skills are fully used in the training sessions. Many children are ready to give their best in the training sessions and competitions; the pride they take in their own achievements is an important reward. Athletes like to believe they are the best in the type of work that is entrusted to them. Athletes must know who the top managers are. The safety of the training sessions is also a significant element.

Regarding the extrinsic motivation index, we have noted that special prizes should be awarded to athletes with excellent results, because the performance of the department depends on the personal results of the athletes. Close attention should be paid to the training conditions and the acknowledgment of the individual performance that exceeds the planning. A higher interest in children should be manifested: ensuring proper equipment (in good condition) for them, extra activities organized besides the training sessions and awarding prizes can improve the performance of children.

As for the beneficial effects of playing basketball and integrating children into a group, some authors argue that private clubs represent almost half of the clubs affiliated to the Romanian Basketball Federation and dominate the competitions reserved to different age categories, which denotes the efficiency of their activity (Grădinaru, 2015). Other researchers focused on raising awareness and motivating the involvement of basketball players in the training process by evaluating the effectiveness of their actions on the basis of the quantity and quality parameters of their executions (Dinciu, 2012).

In order to promote education through sport, more specifically through the basketball game, the Romanian Basketball Federation has started several programs: the kindergarten project “Let’s grow healthy!”’, which is aimed at children aged 3 to 7 years; the program “I want to play basketball!” intended for children aged 7 to 10 years,
which is a stage of the project “Education through Basketball and for Basketball” meant to develop the basketball game in Romania for mini basketball players (Macarescu, 2019; Hora, & Motroc, 2019).

The training of a middle school representative basketball team is an ever-present matter, considering that the methodological, organizational and curricular realities are constantly changing and differ from one school to another. It is important to attract middle school students to practice the basketball game and participate in competitions between classrooms (Ciocan, Fleancu, & Adjudeanu, 2010).

In order to establish the strategic measures meant to develop the motivation of children for practicing extracurricular sports activities like basketball, a careful knowledge of the motor development stage of students at this age is required (Marinescu & Popescu, 2008; Marinescu & Tănase, 2011).

We need to understand that when we pay more attention to the progress of basketball players, we achieve good results with the team accordingly. The club and the coach must have the same objective (Moanţă & Ghiţescu, 2012).

Taking into account the elements mentioned in both the results of the study and the approach of the literature, we can state that the efficient use of managerial activities in organizing and conducting ‘Fair-Play’-type competitions for children has contributed to increasing the motivation for practicing basketball at this level, which validates the hypothesis of this study.

Acknowledgments

This study is included in the subject matter of the doctoral thesis of the first author from the State University of Physical Education and Sport of Chişinău, Moldova. We thank the management of the Club and Mrs Stoian Mihaela-Adriana – CSS6 teacher for their agreement and help granted throughout the study period to achieve our research.

Reference

THEORETICAL ASPECTS OF TOTAL TRAINING INTEGRATED IN THE PHYSICAL TRAINING OF THE FOOTBALL PLAYER

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Abstract. Football is played by millions of people in more than 230 countries, which makes it the most popular sport in the world. Its global influence and interest aroused day by day, the growing attention given to it has made football one of the sports games with the greatest number of players. Many universities around the world are now providing dedicated football programmes. In an organized environment, a major change has occurred as regards the scientific methods of training football players for the competition. The football game is a multidisciplinary sport, so it requires the contribution of a variety of fields and a wide range of specialists. This sport discipline studies the application of scientific principles and techniques in order to improve football performance. In this paper, we are addressing the topic of integrated training or total training, because, in recent years, sports games have required a higher level of preparation for the game.

Keywords: football, physical training, integrated training.

Introduction

The football game is a multidisciplinary sport, so it needs the contribution of a variety of fields and a wide range of specialists. This sport discipline studies the application of scientific principles and techniques in order to improve football performance. The science of football traditionally includes areas of physiology, psychology and biomechanics, but also includes topics such as skill acquisition, performance analysis, technology and coaching science (Bompa & Haff, 2009).

Integrated training involves the transfer of football in all the means of physical training and, in this context, the football player is offered various means, without noticing the difficulty of effort and without interfering with monotony. Football players must be fast in ball possession situations, but also whenever the game requires it. It is necessary for them to work as much sprints as during a match, so over equivalent distances and in equivalent situations, with or without the ball, with or without an opponent. But it is very important for them to mainly work on ball situations (Carlile, 1995). Due to unpredictable game situations, the integrated outfit is useful to put the player in situations as close as possible to the game.

In general, coaches and teams that adopted a scientific approach were rewarded by gaining an advantage over the opponents. It took some time for the accumulation of scientific knowledge to be translated into a form usable by players. Efforts are being made to compile scientific information and make it accessible to the football world.

Topic addressed

Total training is the combination of all the sport training components, namely the physical, technical, tactical and psychological ones. Man is an indivisible whole, and each exercise has a global repertoire with all the training components (Guedj et al., 2006). On the other hand, total training can be defined as an interdisciplinary and multidisciplinary action for the complex and complete development of the athlete (Dragnea & Mate-Teodorescu, 2002). According to Epuran (2001), total training is a human activity performed with maximum efficiency by people at the service of man. Figure 1 shows the total training pattern.
According to Guedj et al. (2006), total training as a task requires the tactical training component, but also includes the following issues:

- physical training must take into account the game phases and field travels;
- the technical component must target all attacking players and defenders;
- the pressure made by the opponents results in the psychological component, which is as important as the other training components;
- the tactical component is always the basis of the game.

Football is a sport where short-lasting sprints, medium-speed racing, jogging and walking are involved throughout the game.

The technical actions to be performed require balance, quality in execution, permanent adaptation of the pace of the player in terms of rate, range and adaptation of the body position. Repeating these gestures and movements requires excellent physical recovery. It is also necessary to repeat these same quality actions throughout the match.

Integrated training aims to replicate the context of a match during the training, with optimal control of the factors specified above, in order to achieve a density of actions that will keep the playing time without losing the technical quality.

Physical training must always be at the service of the game. Therefore, it is necessary to know how to change the physical training planning from the general stage of training to a specific game activity while maintaining the intensity and duration of sessions without the ball.

Most football players are not attracted to physical training and the less they want to actively participate in. This finding should determine coaches to integrate the ball as often as possible into the exercise. This enhances interest and engages the player in these ball moves to replicate the reality of a football match.

The goal of the training is to foster motor education by ball exercises. When mastered, they fully find their place in physical training and allow motor and coordination skills to work well on high volumes. We can say that not using these means would be a serious methodological error in sports training.

This type of training involves:

- player motivation;
- real game situations by increasing the number of biomechanical situations in competition;
- tactics in physical training;
- metabolic needs close to those in the game;
- a reduced number of injuries due to the replication of situations the player is used to doing.

However, there are two disadvantages that need to be analysed:

- load control and training intensity are more complicated;
- organizing the training must be rigorous and requires more attention.
Table 1 shows the advantages of the training with and without the ball.

Table 1. Advantages of the training with and without the ball

<table>
<thead>
<tr>
<th>Training with the ball</th>
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</thead>
<tbody>
<tr>
<td>Increases motivation</td>
<td>Optimum workload control</td>
</tr>
<tr>
<td>Improves the player’s technique</td>
<td>Progress is easy to detect</td>
</tr>
<tr>
<td>Improves tactical intelligence</td>
<td>Comparison of possible players</td>
</tr>
<tr>
<td>Maximises the workout time and load</td>
<td></td>
</tr>
<tr>
<td>Reduces the number of injuries</td>
<td></td>
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</tbody>
</table>

Classification of exercises by number of players according to physiological stress requirements:

- Exercises 8 against 5: are adapted to the development of aerobic capacity (85% to 90% of maximum heart rate);
- Exercises 4 against 3: are adapted to the development of aerobic power (90% to 95% of maximum heart rate);
- Exercises 2 against 2: are adapted to the development of anaerobic capacities (speed, explosive power).

Figure 2 shows another model of integrated circuit training.

Figure 2. Model of integrated circuit training

Workouts can be even more complex, as the ones presented below, which are designed by the authors of this paper; the exercises are used in the fundamental part, therefore those described by us exclude the warm-up part or the recovery of the body after exercise.

*Integrated training 1 - 3 vs. 3 + 1 vs. 1*

Objective: Small-field games aimed at developing specific muscle endurance and increasing lactic acid tolerance

Description: Number of players - 10

Games are played all over the field (105/68 meters). There are two groups of 5 players numbered from 1 to 5.

The game starts with a group of 6 players in the 25/15 field where they play 3 vs. 3. Players with number 4 are positioned on the side of the playing field and start with a 30-m accelerated run to come into possession of a ball offered by coaches in the field “A”. Players matching number 5 come out and perform a 1-to-1 duel with player number 4. Player 4 has to complete the action as quickly and efficiently as possible. At the end of the action, player 5 runs to the playing field. Once entered, players with number 1 wait for 15 seconds, exit the playing area and run fast to perform a game action 1 vs. 1 with player number 4, who has a defensive role this time.

Key points:
1. Players must maintain a high level of involvement, a constant state of combat and competitiveness.
2. We need to make sure that they permanently communicate and are encouraged.
3. We need to encourage them to stay focused throughout the exercise and keep their attention and the quality of executions until the end.

Dosage and organization (Figure 3):
- 5 blocks of 5 minutes with a 3-minute break between blocks;
- In each block of 5 minutes, each “comes out” of the playing surface twice and takes 1 vs. 1 actions, fulfilling both offensive and defensive roles, 2 times each.
- The training was designed for the senior team of the University of Craiova and was applied especially as a compensatory step on the day after the game for the players who had not played the day before.

Figure 3. Integrated training 1 - 3 vs. 3 + 1 vs. 1

Integrated training 2 - 5 vs. 5 with the change of courts

Objective: Small-field games aimed at developing specific muscle endurance and increasing lactic acid tolerance

Description: Number of players - 20
Games are played all over the field (105/68 meters). Two groups of 10 players are made up. Each group is divided into two teams of 5 players.

The game starts with a group in the field “A” and the second group in the field “B”

In the field “A”, a 5 vs. 5 is played at large gates over an area of 35/25 meters for 5 minutes.

In the field “B”, they play 5 vs. 5 at small gates over an area of 25/15 meters for 2 minutes and 30 seconds. Every 30 seconds, a nominated player from each team comes out and runs to complete 5 balls, 1A and 1B. After completion, the player returns to the playing area and two other players will come out. At the end of the 2 minutes and 30 seconds, they run from the field “B” to the field “C”, following the same rule as in the field “B”. After the 5 minutes, players from the field “A” will pass successively through the fields “B” and “C” 2 minutes and 30 seconds, and the group from the field “C” will go on playing for 5 minutes on the field “A”.

Key points:
1. Players must maintain a high level of involvement, a constant state of combat and competitiveness.
2. We need to make sure that they permanently communicate and are encouraged.
3. We need to encourage them to stay focused throughout the exercise and keep their attention and the quality of executions until the end.

Dosage and organization (Figure 4):
- 3 blocks of 10 minutes with a 3-minute break between blocks;
- In each block of 10 minutes, each team plays twice in the field with small gates and once in the big field at large parts with goalkeepers. During the 5 minutes of play on the small fields, we make sure that each player has 10 shots for goal (5 in the field “B”, and 5 in the field “C”);
- The training was designed for the senior team of the University of Craiova and is applied in the competitive microcycle in the days when we want to develop aerobic power in a more specific way.
Conclusions

Consequently, it is recommended to increase exercise intensity by reducing interruptions. Non-tutoring exercises allow multi-player work while maintaining a high intensity. In addition, by giving instructions such as reducing the number of ball touches, the pace of the game accelerates even more.

Player training with the ball leads to improved sprint and agility. Player training without the ball must have the same qualities. In addition, there is greater progression in the game-specific aerobic exercise.

In the first part of the preparatory period, much of the training should be done without ball exercises. This is for the workload to be mastered by groups and different levels of players. But, from the beginning and progressively, it is necessary to introduce ball exercises into the training, depending on the chosen exercise, the size of the field and the number of the players in the team. These exercises must be introduced without the player realizing that he will work on the various components desired and without feeling the request that we impose.

References

THE IMPACT OF ADVENTURE EDUCATION ACTIVITIES ON THE DEVELOPMENT OF ARM STRENGTH

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Abstract. Adventure activities have been part of the physical education (PE) lessons of other countries for a long time, yet they are still missing from the Romanian curriculum. This paper analyses the effect of an extra PE lesson based on activities specific to adventure education on the development of strength in students aged 10-12 years. The program consisting in initiatives, low-ropes elements, orientation activities and specific games was implemented in a school from Cluj-Napoca between September 2016 and April 2017. In this experiment with a pre- and post-test design, the effect of the program was measured using hand dynamometry. Results show a significant growth for both groups in the right hand and overall strength, but in the left hand, they only show a significant growth for the control group. Comparison of post results and comparison of gain scores show slightly better results for the test group but not significant at p < 0.05. However, the results indicate a small to medium effect size for the difference between post scores (d = .30) in favour of the test group. The results also indicate a small to medium effect size for the right hand in the gain scores (d = .25). We conclude that, despite the fact that adventure education activities have in general a positive effect on arm strength development, this is small and mostly applies for the dextrous arm.

Keywords: adventure education, dynamometry, arm strength.

Introduction

Adventure education is a branch of education that focuses on interpersonal and intrapersonal development, using for this activities that involve risk and challenge (Priest, 1999; Bailey, 1999; Hirsch, 1992; Stremba, 2009; Ewert & Garvey, 2007). Adventure education is a type of experiential learning (Walsh & Golins, 1976; Bailey, 1999; Hirsch, 1999; Raiola & O’Keefe, 1999) that finds its origin in the 1940s, in Great Britain (Ewert & Sibthorp, 2014; Loynes, 1999; Miner, 1999; Prouty, 2007), even though its philosophy and principles can be traced further back.

The program that started this form of education was aimed at developing independence, initiative, self-confidence, inventiveness, as well as the fitness level (Hattie et al., 1997; Richards, 2013). However, in time, adventure education focused more on specific aspects of personal and social development, and physical development lost its position as a main objective (Hattie et al., 1997). One can say that the physical aspect of adventure education has started to be seen just as a means to reach the other objectives.

Despite the fact that some schools had adventurous activities in their programs beforehand, mainly hiking and camping, adventure education itself found its position in schools around the 1970s and was included in the physical education curriculum from the beginning (Raiola & O’Keefe, 1999). The first adventure education curriculum in the USA was based on initiatives, rock climbing and rope courses (Raiola & O’Keefe, 1999), and even though some schools manage to offer some more spectacular activities, these still form the core of most adventure education programs in schools (Panicucci et al., 2002).

Looking through the published research, we have found some qualitative studies that identify physical benefits in the adventure education programs (Goldenberg, McAvoy, & Klenosky, 2005; Kellert, 1998), but specialists agree there is a need for more studies in this direction (Gillis & Speelman, 2008; Ewert & Sibthorp, 2014). We managed to identify only three such studies, one published by Fersch and Smith in 1978 that found improvement in abdominal and arm strength, as well as short- and middle-distance running, one published by Quinby in 1982 that found no significant differences between the test and control groups for endurance, flexibility, core strength and body fat, and the last one done by Gehris in 2011 that used four items from FITNESSGRAM (pushups, torso lift, the PACER test and a flexibility test), but found no significant differences between the test and control groups (Gehris, Myers, & Whitaker, 2012).

This paper publishes part of the research done for the doctoral thesis of the main author. The thesis is focused on the social and personal benefits that an adventure education program can bring to the students, while it also tries to find proof that it brings enough physical benefits to support the introduction of such activities in the physical education curriculum. From the standpoint of the physical benefits, the research analysed the effects of
such a program on the cardiovascular endurance, dynamic balance and arm strength of the participants. This paper will only present the findings related to the arm strength, the other results being published in other papers.

**Material and methods**

**Participants**

The study was conducted on a group of 56 middle school students aged 10-12 years. Both the experimental and control groups consisted of a 5th-grade classroom and a 6th-grade classroom that were randomly allocated to one of the groups. The final distribution of the subjects was balanced from the gender point of view.

**Instruments**

The instrument used is an electronic dynamometer with adjustable handle that allows adaptation to the hand size of the participants. The dynamometer can record forces of up to 90 kg and is sensible enough to identify variations of 100 grams. Before the initial test, the instrument was tested on a couple of students and, based on their feedback, the handle was set to position 2 for the experiment.

**Procedure**

Considering there are several studies that show a strong correlation between the handgrip strength and strength of other muscles (Bohannon, 1998; Fricke & Schoenau, 2005; Wind et al., 2009) and even the papers arguing against this still agree that the handgrip strength is a good indicator of the overall strength for the respective arm (Bohannon, 2008), testing of the arm strength of the students was done through handgrip dynamometry. This test is found in the EUROFIT test battery (Council of Europe, 1983), and the procedure implies holding the dynamometer in the hand in such a way that its base is in full contact with the heel of the palm and the handle leans on the middle of the 4 fingers and then squeezing the apparatus as strongly as possible for 3-5 seconds, depending on the protocol (Wood, 2008). There are various protocols related to this test that have different instructions for the position of the arm, the position of the participant or the way to record the results (Roberts et al., 2011). In our study, the participants were tested in a standing position with the arm by the side of the body and the best result out of three attempts was recorded for each arm.

Testing was done at the beginning of the program and again at the end of the part of the program relevant to strength development, even if the program itself continued with orientation activities.

For the study, the experimental group took part in an extra physical education lesson every week where the preadolescents participated in activities specific to adventure education like games, initiatives, low-ropes elements and even orientation. While the adventure education program used for this research was constructed with the main aim of developing social and personal aspects, the activities were selected in such a way as to be dynamic, be adaptable to the space and resources available, and require a level of balance, strength or cardiovascular endurance.

The orientation activities were implemented at the beginning and the end of the program because of the potential they had to develop dynamic balance or cardiovascular endurance and were not relevant for arm strength development. Except orientation, most of the activities took part inside the gym.

The rope elements are obstacles mainly constructed of ropes and wood attached in different ways and set above the ground at various heights, and they usually require to be crossed by participants with the physical or moral support of the group. The rope elements can be high, and this requires the use of a harness for safety, or low, which require only assistance or mats for safety. For our program, we allowed the preadolescents to construct various types of low-ropes elements, using a prepared environment and various materials like hooks attached to the ceiling, benches, gymnastics vaults and different types of ladders, in order to be able to cross between two set locations. To solve the task, the group had to hold the elements into position using their own strength while as many classmates as possible crossed them. This approach allowed for a better motor density in the lesson as all the students had to be involved at any time.

Initiatives are tasks that need to be solved by the participants and they usually require the involvement of all the group members. Some specialists consider the initiatives as part of the large category named rope courses, together with the games, ice breakers and trust activities (Martin et al., 2006 as cited in Gillis & Speelman, 2008; Rohnke, 1989), but even though some activities fit both descriptions, initiatives do not always require ropes and can also be performed on ground level.
The games specific to adventure education have the purpose of activating the participants and prepare them for the initiative while helping in the achievement of the interpersonal development. The games used in the program are focused on cooperation with the whole group, part of it, or at least one partner.

The rope courses, as considered by Rohlake (1989) and Martin et al. (2006 as cited in Gillis & Speelman, 2008), are the main type of activity used in adventure education in the urban environment. Their advantage is that they are adjustable to the need of the program and the space available (Goldenberg et al., 2000; Moote & Wodarski, 1997).

More information about the activities and the program will be published in a separate paper.

According to the challenge-by-choice principle of Adventure Education, every student was allowed to decide if a challenge was too much for him/her and opt out for some aspects of the activity, but they still had to be involved in the activity in a way and support the other group members.

Meanwhile, the control group also had an extra physical education lesson, but for them, the activities focused on further development of the skills and fitness components trained in the main lessons. The activities done by the control group were related to cricket, table tennis, gymnastics, basketball and rugby, and included specific fitness development as well.

Results

From the dynamometric measurements, we obtained three sets of data for each case, representing strength of the right arm, strength of the left arm and an average of the two.

An initial analysis of the data has shown that, on average, preadolescents have slightly more strength in the right arm (m = 18.45) compared to the left arm (m = 18.08). Considering that most students were right-handed, this does not come as a surprise.

The Shapiro-Wilk test has shown that the distribution of the initial scores can be considered normal for both groups, for all three sets of data, which is confirmed by the skewness and kurtosis scores as well; however an outlier was identified on the boxplot graph in the experimental group so, for this reason, the difference between the initial scores of the groups was tested using the Mann-Whitney test. When compared, no significant differences were found between the experimental and control groups for the initial tests.

Further on, we calculated for each case the difference between the final and initial scores. Based on the Shapiro-Wilk test, the distribution of the growth scores for right hand strength for the experimental group was not considered to be a normal distribution (statistic = .912, df = 28, p = .022), but after checking the skewness (−.684, SE = .441) and kurtosis (−.510, SE = .858), we decided that we could still use parametric statistics for this variable. The distribution of the other sets of data was normal based on Shapiro-Wilk and no outliers were identified.

In order to check the improvement in strength for each arm and in average, we used the dependent t-test, and the results showed significant growth for the right arm and in average for both groups, but for the left arm, only for the control group. The detailed results can be seen in Table 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>Variable</th>
<th>Paired differences</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>SEM</td>
<td>95% CI</td>
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<td>control</td>
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<td>2.25</td>
<td>.42</td>
<td>.22</td>
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<tr>
<td></td>
<td></td>
<td>left strength</td>
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<td>.43</td>
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<tr>
<td></td>
<td></td>
<td>right strength</td>
<td>1.22</td>
<td>2.51</td>
<td>.47</td>
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<tr>
<td>Test</td>
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<td>.53</td>
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<td></td>
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<td></td>
<td></td>
<td>right strength</td>
<td>1.80</td>
<td>2.02</td>
<td>.38</td>
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</table>

Note: SD – standard deviation, SEM – standard error of the mean, CI – confidence interval, LL – lower limit, UL – upper limit, df – degree of freedom, p – statistical significance

Considering that both groups showed a significant growth in strength, we compared the end results of the two groups using the independent t-test. Despite slightly better results for the experimental group, none of the variables showed significant differences at p < .05, as you can see in Table 2. However Cohen’s $d$ indicates an effect size of 0.30 for the right and left hands and a 0.31 effect for average strength, all in favour of the experimental group.

Table 2. Comparison of strength between final and initial testing (T2-T1) for each group

<table>
<thead>
<tr>
<th>Group</th>
<th>Variable</th>
<th>Paired differences</th>
<th>t</th>
<th>df</th>
<th>p</th>
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<td>1.01</td>
</tr>
</tbody>
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Note: SD – standard deviation, SEM – standard error of the mean, CI – confidence interval, LL – lower limit, UL – upper limit, df – degree of freedom, p – statistical significance

Table 1. Comparison of strength between final and initial testing (T2-T1) for each group
 Considering that the initial scores also showed a higher mean for the experimental group, for each variable, as compared to the control group, we decided that a comparison of the growth scores might be more appropriate. The comparison was done using independent t-tests and the results showed that the difference between the growth of the groups is not statistically significant for any variable at p < .05, and even pointed out that the control group had better strength growth for the left arm (MD = -2.57). However, for the right arm, the experimental group showed better growth (MD = .578, t = .949, df = 54, p = .347), and indicated an effect size of ES = 0.25. The effect size was calculated again using Cohen’s d and was considered to be small (Cohen, 1988). Because the distribution of the growth scores was deemed abnormal based on Shapiro-Wilk, the difference between the test and control groups for right hand growth in strength was analysed using the Mann-Whitney U test as well, but it returned similar insignificant results (z = .820, p = .412) and small effect size (r = 0.10). The effect size for Mann-Whitney was calculated with the formula \( r = z / \sqrt{N} \) (where N = total number of cases) and interpreted according to Cohen (1988).

### Conclusions and discussions

The statistical results showed that both groups significantly improved their strength between the initial test and the final test, and despite the fact that the experimental group had slightly better growth for the right arm and the average strength of both arms, the difference was not statistically significant. The small effect size noticed in relation to the growth in strength of the right arm for the experimental group compared to the control group (calculated based on both parametric and nonparametric tests) indicates that there is, on average, more growth in the strength of the right arm for the preadolescents in the experimental group, but suggests that a larger number of subjects would have been needed in order to get some significant results. Wolf (1986, as cited in Gillis & Speelman, 2008) interprets an effect size of .25 as being educational.

Considering that the students in both groups were doing the same activities during their regular physical education lessons, the results obtained can lead us to the conclusion that our program had almost no effect on strength development and what we see is the result of the activities from the main physical education lessons. However, we need to keep in mind that, while the experimental group had an extra lesson every week where they took part in adventure education activities, the control group was using the 3rd lesson to further train the same skills and fitness components worked on during the main lessons. So, if the conclusion mentioned above is true, the control group should have better growth in strength, which is not the case. This allows us to consider that adventure education activities might have had an effect on arm strength, but it was similar to the effect of gymnastics and fitness activities done in the main lessons.

If we are to analyse the activities used for the experiment, based on observations made during the lessons, we can definitely state that low-ropes activities and several initiatives require participants to have a good level of arm strength; however, there were some issues that limited the amount of time when the students were effectively engaged in aspects requiring the use of arm strength. While some activities required all participants to use their arm strength in the same time, in other activities, they had to share responsibilities between them, with only some positions requiring the use of arm strength. There was a tendency to have the same students, more confident in their strength ability, to try to take those positions requiring arm strength, despite our efforts to make them rotate responsibilities. The limitations of the space and materials also meant that, in some activities, participants were doing the activity in turns, making the rest time longer than needed.

A study made by Gehris et al. (2012) with the intention to check the motor density of the physical education lessons where students took part in adventure activities has showed that there is less density of moderate and high-intensity effort in those lessons (13.7%) compared to traditional lessons (28.3%). The study was conducted with
middle-school students. We need to keep this in mind when we analyse the physical effects of adventure-type activities in comparison with the results of other physical education activities and understand that, despite their possible benefits for the development of various fitness components, it might take longer for visible results to appear.

In conclusion, our results suggest that there could be some benefits in using adventure-type activities to develop arm strength, but for the activities used in our program, they are at most as great as the effects of other activities used in physical education lessons, like gymnastics, and the benefits are pretty much limited to the right arm. Considering that almost all tested preadolescents were right-handed, we can assume that the development is related to the dexterous arm and this is not accidental, but instead is related to the way strength was used during the activities.

Further studies are needed to check the effect of specific adventure activities compared to various activities traditionally used in physical education lessons for the development of strength. Our suggestion is that such studies should focus on selecting the right type of adventure activities in order to increase the motor density during the activities and increase the quality and amount of workload on the muscles.

References
STUDY ON THE IMPROVEMENT OF SHOOTING ACCURACY IN ROMANIAN WHEELCHAIR BASKETBALL PLAYERS

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Abstract. The preparation of international wheelchair basketball players currently requires a high level of technical-tactical basketball content. The shot is the most important element of the basketball game, which expresses the ultimate goal of the game, based on the player’s neuromuscular coordination. In this paper, we aim to present some aspects regarding the shooting percentage of the Romanian wheelchair basketball players. We can say that this sport follows a developmental trend, but we are still at an early stage, because, in our country, there are not any championships, there are only isolated specific competitions. In Romania, wheelchair basketball is an amateur sport. We developed a training program based on the daily schedule of athletes, where we introduced 1-2 weekly training sessions. This training program was attended by 34 Romanian athletes from 4 teams (“Roțile Astrale” Sport Club Association – Sibiu, “Roțile Schimbării” Sport Club Association – Prahova, AJIF Motivation – Ilfov, “Fii Independent” Sport Club Association – Brașov), who were divided into two groups. The objective of this study was to improve shooting accuracy of lay-up and free throws.

Keywords: wheelchair, basketball, shot, accuracy.

Introduction

The preparation of international basketball wheelchair players currently requires a high level of technical-tactical basketball content. The shot is the most important element of the basketball game, which expresses the ultimate goal of the game, based on the player’s neuromuscular coordination (Moanță & Ghițescu, 2013). Basketball training gets different aspects and adapts according to the training category (Moanță, Tudor, & Ghițescu, 2013). In this paper, we aim to present some aspects regarding shooting percentage of the Romanian wheelchair basketball players. We can say that sport follows a developmental trend, but we are still at an early stage, because, in our country, there are not any championships, there are only isolated specific competitions (Săftel & Grigore, 2018).

Kevin Coombes is one of Australia’s most successful wheelchair basketball players, who has participated in five Paralympics and therefore is highly experienced. Kevin has exceptional shooting abilities, performing a two-handed shot, which is his common way of shooting during the game.

In recent years, wheelchair basketball has attracted many coaches from the able-bodied game of basketball and many wheelchair basketball players have used the one-handed shooting technique, which is common in able-bodied basketball. The one-handed shot has a higher release point, which makes it harder to block, however, there still remains a place for the two-handed shot in wheelchair basketball, particularly for players that do not have the strength for the one-handed shot or for those players wanting to increase their shooting range (Ettridge & Haynes, 2017).

Measuring players’ performance in team sports is fundamental since managers need to evaluate players with respect to their ability to score during crucial moments of the game. Using the Classification and Regression Trees (CART) and play-by-play basketball data, one can estimate the probabilities to score the shot with regard to a selection of game covariates related to game pressure. Scoring probabilities are used to develop a player-specific shooting performance index that takes into account the difficulty associated to scoring different types of shots (Metulini & Le Carre, 2019).

Material and methods

Participants

To conduct this research, we analysed 34 Romanian wheelchair basketball players from 4 different clubs in 4 different cities (“Roțile Astrale” Sport Club Association – Sibiu, “Roțile Schimbării” Sport Club Association – Prahova, AJIF Motivation – Ilfov, “Fii Independent” Sport Club Association – Brașov). We divided the players into two groups, namely the experiment and control groups. The criteria used to divide them were:

- Number of players and their disabilities (the number must be identical);
- Location of the training sessions.
Procedure

The volume of training:
1. Number of weeks: 40
2. Number of training sessions per week: 1-2
3. Total number of training sessions: 56
4. Duration of a training session: 100 minutes
5. Total number of training hours per year: 93

Example of exercises used in a training session for the experimental group: at the beginning of your workout, you should focus on the shooting form for a little while. This will help to keep your mechanics from slowly drifting in the wrong direction. For this, we spend about 15-20 minutes practicing the following:

- shooting the ball with one hand near to the basket/hoop (this can be to a partner, line on the floor, or spot on the wall) – 10 shots from different angles and distances – 10 series;
- changing up where the shot is taken from between these five shots:
  1. Near to the basket, maximum 1.5 m;
  2. Mid-range shots;
  3. 1-dribble pull-up shots;
  4. Free throw;
  5. Floater/Layup;
- throwing contest – the first to score 10 points. For each basket, the player receives 1 point:
  1. Near to the basket, maximum 1.5 m;
  2. Mid-range shots;
  3. 1-dribble pull-up shots;
  4. Free throw;
  5. Floater/Layup.

Example of exercises used in a training session for the control group (working according to the training plan provided by the coach):

- 10 shots from different angles – 6 series;
- players at the top of the key dribble down and perform a handoff with a wing player cutting to the top of the key, who then takes the shot or drives for the layup;
- a line of players at half court and on the wing, and a single player on the free-throw line. The player at half court passes to the player at the free-throw line, who then passes to the cutting-wing player for a layup;
- 2 shots in a row from the free-throw line.

Tests

- **Free throws**
  Description: 5 free throws
  Objective: Evaluate the ability of shooting a free throw
  Evaluation: Number of marks from 5 attempts
  Number of series: 1

- **Layup**
  The athlete leaves the bottom line of the basketball field, receives the ball from the coach who is at the 6.75 m line, dribbles by passing the cone positioned at 6.75 m on the right side at 45 degrees to the basket, dribbles to the basket and finishes with a layup following the same route on the left.
  Objective: Evaluating the right-hand layup shooting and left-hand layup shooting
  Evaluation: Number of marks from 10 attempts, 5 on the right, 5 on the left
  Number of series: 1

Results

For the statistical analysis, we applied the t-test, namely the Two-Sample Assuming Equal Variances from the Excel Data Analysis Software package, of which we analysed the following: mean, standard deviation, coefficient of variation, t-Stat and t-Critical two-tail, with alpha being 0.05.
Table 1. *T*-Test: Two-Sample Assuming Equal Variances – Preliminary Lay-Up Test

<table>
<thead>
<tr>
<th></th>
<th>Preliminary Lay-Up Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
</tr>
<tr>
<td>Mean</td>
<td>2.29</td>
</tr>
<tr>
<td>Coefficient of variation</td>
<td>32.55%</td>
</tr>
<tr>
<td>Observations</td>
<td>17</td>
</tr>
<tr>
<td>Hypothesised mean difference</td>
<td>0</td>
</tr>
<tr>
<td>Df</td>
<td>32</td>
</tr>
<tr>
<td>T-Stat</td>
<td>0.63</td>
</tr>
<tr>
<td>P(T&lt;=t) one-tail</td>
<td>0.27</td>
</tr>
<tr>
<td>t-Critical one-tail</td>
<td>1.69</td>
</tr>
<tr>
<td>P(T&lt;=t) two-tail</td>
<td>0.54</td>
</tr>
<tr>
<td>t-Critical two-tail</td>
<td>2.04</td>
</tr>
</tbody>
</table>

Considering that the coefficient of variation has the values 32.55% and 31.43%, which are below the 35% threshold, it results that both groups are homogeneous. There are no significant differences between the two groups, because *t*-Stat has a value of 0.63, being lower than *t*-Critical two-tail, 2.04 (Table 1).

Table 2. Results of the Lay-Up Test

<table>
<thead>
<tr>
<th>Lay-Up 10 (Preliminary)</th>
<th>Lay-Up 10 (Final)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control Score</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>mean</td>
<td>2.29</td>
</tr>
<tr>
<td>max</td>
<td>4.00</td>
</tr>
<tr>
<td>min</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Analysing Table 2, it has been noted that, in the preliminary test, the control group had better results than the experimental group, averaging 2.29. In the final test, both groups made little progress; thus, the control group recorded 2.35% (25.29%-22.94%), and the experimental group, 8.24% progress, but the results were better in favour of the experimental group, averaging 2.88. Analysing the minimum indicator, both groups had athletes who failed to score, having 0.
Table 3. T-Test: Two-Sample Assuming Equal Variances – Final Lay-Up 10 Test

<table>
<thead>
<tr>
<th></th>
<th>Final Lay-Up 10 Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experiment</td>
</tr>
<tr>
<td>Mean</td>
<td>3.12</td>
</tr>
<tr>
<td>Coefficient of variation</td>
<td>30.13%</td>
</tr>
<tr>
<td>Observations</td>
<td>17</td>
</tr>
<tr>
<td>Hypothesised mean difference</td>
<td>0</td>
</tr>
<tr>
<td>Df</td>
<td>32</td>
</tr>
<tr>
<td>t-Stat</td>
<td>2.86</td>
</tr>
<tr>
<td>P(T&lt;=t) one-tail</td>
<td>0.04</td>
</tr>
<tr>
<td>t-Critical one-tail</td>
<td>1.69</td>
</tr>
<tr>
<td>P(T&lt;=t) two-tail</td>
<td>0.07</td>
</tr>
<tr>
<td>t-Critical two-tail</td>
<td>2.04</td>
</tr>
</tbody>
</table>

Since the coefficient of variation has values of 30.13 and 29.13, which are below the 35% threshold, it results that both groups are homogeneous. There are no significant differences between the two groups, because P(T<=t) two-tail is 0.07 higher than alpha 0.05 (Table 3).

Table 4. Results of the Free-Throw Test

<table>
<thead>
<tr>
<th></th>
<th>5 Free Throws (Preliminary)</th>
<th>5 Free Throws (Final)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Experiment</td>
</tr>
<tr>
<td>Score</td>
<td>Score</td>
<td>Score</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>average</td>
<td>1.18</td>
<td>1.18</td>
</tr>
<tr>
<td>max</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>min</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Analysing Table 4, one can see that, in the preliminary test, the same average of 1.18 free throws (24%) is recorded. In the final test, both groups made little progress; thus, the control group recorded 2.35%, and the experimental group, 7.06% progress. Analysing the minimum indicator, both groups had athletes who failed to score, having 0.
Table 5. *T-Test: Two-Sample Assuming Equal Variances – Preliminary Free Throw*

<table>
<thead>
<tr>
<th></th>
<th>Experiment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>1.18</td>
<td>1.18</td>
</tr>
<tr>
<td><strong>Coefficient of variation</strong></td>
<td>33.12%</td>
<td>34.11%</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td><strong>Hypothesized mean difference</strong></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Df</strong></td>
<td>32</td>
<td></td>
</tr>
<tr>
<td><strong>t-Stat</strong></td>
<td>-0.63</td>
<td></td>
</tr>
<tr>
<td><strong>P(T&lt;=t) one-tail</strong></td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td><strong>t-Critical one-tail</strong></td>
<td>1.69</td>
<td></td>
</tr>
<tr>
<td><strong>P(T&lt;=t) two-tail</strong></td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td><strong>t-Critical two-tail</strong></td>
<td>2.04</td>
<td></td>
</tr>
</tbody>
</table>

Considering that the coefficient of variation has values of 33.12% and 34.11%, which are below the 35% threshold, it results that both groups are homogeneous. There are no significant differences between the two groups, because t-Stat has a value of -0.63, being lower than t-Critical two-tail, 2.04 (Table 5).

Table 6. *T-Test: Two-Sample Assuming Equal Variances – Final Free Throw*

<table>
<thead>
<tr>
<th></th>
<th>Experiment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>1.41</td>
<td>1.29</td>
</tr>
<tr>
<td><strong>Coefficient of variation</strong></td>
<td>30.1%</td>
<td>29.1%</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td><strong>Hypothesized mean difference</strong></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Df</strong></td>
<td>32</td>
<td></td>
</tr>
<tr>
<td><strong>t Stat</strong></td>
<td>2.46</td>
<td></td>
</tr>
<tr>
<td><strong>P(T&lt;=t) one-tail</strong></td>
<td>0.32</td>
<td></td>
</tr>
<tr>
<td><strong>t-Critical one-tail</strong></td>
<td>1.69</td>
<td></td>
</tr>
<tr>
<td><strong>P(T&lt;=t) two-tail</strong></td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td><strong>t-Critical two-tail</strong></td>
<td>2.04</td>
<td></td>
</tr>
</tbody>
</table>

Since the coefficient of variation has the values 30.13 and 29.1, which are below the 35% threshold, it results that both groups are homogeneous. There are no significant differences between the two groups, because p > 0.05 (Table 6).

**Conclusion**

Analysing the recorded values, we conclude:

- According to Table 2, we can see that the differences are not significant, but the experiment group has improved the accuracy of lay-up by 8.24%, and the control group, by only 2.35%, the difference being 5.88%.
- According to Table 4, we can see that both groups have the same result in the preliminary test, but in the final test, the experimental group has increased the percentage with 4.71% compared to the control group.
- Final percentages for the free throw (25.88%) and lay-up (30.59%) are very low and are not competitive with other international teams. This low percentage is due to poor physical training and the small number of training sessions.
- We aim to increase the number of workouts focused on shooting accuracy in order to achieve significant differences in shooting percentages.
Acknowledgment

This paper is made under the aegis of the National University of Physical Education and Sport, Doctoral School. We would like to thank the Motivation Foundation for all their support in this research.

References


STUDY ON THE LEARNING OF BADMINTON TECHNIQUE IN 6-7-YEARS-OLD CHILDREN

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Abstract. At the age of 6-7 years, it is not efficient and not even possible to approach the whole technical-tactical content specific to badminton. The time spent in the training hall in the first year of training is devoted to the learning of indispensable shots for simple play: the forehand service, the forehand clear and the backhand net lift. Developing the coordination-speed couple is also a prime objective in this period of training, as well as the use of gaming and other attractive means, so that we can cultivate in younger athletes the pleasure of practicing badminton. The aim of the study is to highlight the effects of a training program primarily aimed at the learning of badminton-specific technical procedures by children aged 6-7, players of the School Sports Club (CSS) Bacău. The research methods used were: the bibliographic study, the experimental method, the pedagogical observation method, the statistical-mathematical method and the graphical method. The subjects of the study were 36 children divided into two equal groups: one experimental and one control group. For 7 months, they participated in 3 training sessions per week, each training session lasting 75 minutes. The hypothesis that “the use of a 7-month training program aimed at initiating children aged 6-7 years to badminton leads to statistically significant differences between the initial and final results recorded in the technical assessment tests” is confirmed.

Keywords: training, badminton, technical procedures, learning, assessment.

Introduction

The complexity of badminton, often understood only by those who practice or study this sport, derives from the fact that players have multiple options to hit a shuttle that can reach speeds of up to 425 km/h in a space of considerable size: 35 m². Under these conditions, the intensity of the game gets the highest rates in the world of racket sports.

As in many other sports, the age of initiation to badminton has dropped significantly over time, so that, if in 2001, it was 10-12 years old (Bompa, 2001, p. 31), the initiation occurs now at 6-7 years old. This age is unanimously accepted as the ideal age to start training in badminton, even if a large number of children face many coordination problems when it comes to hitting the shuttle with the racket. In this context, the development of coordination through attractive means becomes the most important objective of the training process.

At the national level, the method of teaching badminton is a topic approached by very few specialists. Most of the badminton studies (Lăzărescu, 1974; Demeter-Erdei, 1983, p. 36; Marcu, 1989) contain chapters on the technique, tactics and rules of the game, as well as the specific effort. The methodological approach is limited to exemplifying some exercises used in teaching specific shots (Ochiană, 2006; Rus, 2008; Ștefan & Stăninescu, 2016).

As a consequence of neglecting this topic, if you enter multiple badminton halls in the country, you can see different ways of teaching the technical procedures specific to this sports game. For example, some coaches teach their athletes to wait for the shuttle in the lateral position of the net for high shots, while others use their chest position towards the net, some coaches initially use suspended shuttles, while others start throwing shuttles (hand feeding), some do not approach the court movement in the first year of training, others approach it from the first training, some use rackets at each lesson, others use rackets very little in the first year of training.

So, at least at national level, there has not yet been a well-established teaching methodology accepted as the most efficient, and the shortest way to the desired technical skill has not yet been found, which is why developing and testing new training programs are steps that could lead to overcoming the current boundaries of the training process.

The purpose of the study is to highlight the effects of a training program primarily aimed at the learning of badminton-specific technical procedures by children aged 6-7.

By carrying out this study, we intend to verify the following hypothesis: the use of a 7-month training program aimed at initiating children aged 6-7 years to badminton leads to statistically significant differences between the initial and final results recorded in the technical assessment tests.
Material and methods

We used the following research methods: the experimental method, the pedagogical observation method, the statistical-mathematical method, analytical and graphical methods.

Participants

The experimental group subjects were 18 students (9 boys and 9 girls) in their preparatory school year at the “Spiru Haret” Middle School in Bacău. The children were randomly chosen from two preparatory classrooms, their average age being 6.4 years.

The control group subjects were 18 students (7 boys and 11 girls) in their preparatory school year at the “N. V. Karpen” College in Bacău. The children were randomly chosen from two preparatory classrooms, their average age being 6.3 years.

Procedure

The research was conducted over a period of 7 months, from September 2018 to March 2019. During the research, the subjects participated in 3 training sessions per week (on Tuesdays, Thursdays and Saturdays), each lesson lasting 75 minutes. The training was mainly focused on learning the technical procedures of badminton. During the 7 months of preparation, the bilateral game took place on a half-court, including the corridor for doubles, as suggested in Figure 1 (the space in the game is framed in the red box).

![Playing court](image)

Figure 1. The playing court in the first 7 months of preparation at the age of 6-7 years (the space is framed in the red box)

Starting from the idea of playing on a half-court, the technical procedures approached during the 7 months of training and their sequencing in the teaching process were selected as follows:

1. Forehand grip.
2. Forehand clear. Practicing it creates the opportunity to introduce the first footwork element: using the chasse step to adjust the player’s position relative to the shuttle.
3. Long forehand service.
5. Backhand net lift. The practice of this shot is a good opportunity to introduce another footwork element: using the lunge with the foot to arm in order to bring the player closer to the shuttle.
6. The fundamental position. Acquiring this position is a good time for introducing the first tactical aspect of the game: returning to the centre of the court after each shot.
7. Backward movement perpendicular to the back boundary line.
8. Forward movement perpendicular to the net.
9. Forehand drop. Practicing this shot is a good time for introducing another tactical aspect of the game: moving the opponent according to one’s position on the court (sending the shuttle as far as possible from the opponent).

The main characteristics of the training program developed by us (used for the experimental group) compared to the traditional training program (used for the control group) are presented in Table 1.
Table 1. Comparison of the training program used for the experimental group with the training program used for the control group

<table>
<thead>
<tr>
<th>Characteristics of the program used for the experimental group</th>
<th>Characteristics of the program used for the control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>the use of suspended shuttles in the first phase of learning shots</td>
<td>the use of hand feeding shuttles by the coach in the first phase of learning shots</td>
</tr>
<tr>
<td>the use of rackets with less than the standard rod length</td>
<td>using standard rackets</td>
</tr>
<tr>
<td>approaching the following shots: forehand clear, forehand drop and backhand net lift</td>
<td>approaching the following shots: forehand clear, forehand net lift</td>
</tr>
<tr>
<td>learning the forehand clear from the high-shuttle stand position (side-to-face position)</td>
<td>learning the forehand clear by having the trunk turned to the net</td>
</tr>
<tr>
<td>the bilateral game takes place on half-court</td>
<td>the bilateral game takes place all over the court</td>
</tr>
<tr>
<td>learning to move forward and backward in a straight line</td>
<td>learning lateral footwork</td>
</tr>
<tr>
<td>tactical elements approached: returning to the centre of the court after each shot and sending the shuttle as far as possible from the opponent</td>
<td>tactical elements addressed: -----</td>
</tr>
</tbody>
</table>

Three technical procedures were assessed in the study: forehand clear (Figure 2), backhand net lift and long forehand service. To evaluate the technical level, we used an adaptation of the badminton rating scale — after Bobrich (Barrow, McGee, & Tritschler, 1989, pp. 154-156), designed on four technical levels: 0 to 3. The adjustment consisted in the fact that the shots were executed using the suspended shuttle instead of being executed by the opponent, and the execution of the shots did not take place in bilateral games, but under static conditions, isolated from the game.

The average shot speed was evaluated using the Actofit Badminton Tracker (2018) electronic device. This device is mounted to the end of the badminton racket handle and measures various parameters, including the speed of the shots. Calculated parameters can be read using a smartphone and the installed software. Actofit Badminton Tracker was launched at the Premier Badminton League, India, 2018, and the Actofit brand was also used in research by prestigious centres such as the University of Washington or the “Datta Meghe” Medical Sciences Institute.

Results

We present the result analysis for the two groups of participants in the five tests aimed at the learning of technical procedures in badminton. For the technical level of the forehand clear, the experimental group achieved 4-point progress, the average values being 11.88 points in the initial test and 15.88 points in the final test. The control group achieved a progress of 2.33 points, the average values being 12.11 points in the initial test and 14.44 points in the final test.
The coefficient of variation of 28% recorded by the experimental group in the final test indicates a relatively homogeneous dispersion around the average of the measured data. The coefficient of variation of 29% recorded by the control group in the final test also gives a relatively homogeneous dispersion of the measured data.

In the experimental group, the effect size index \( (d) \) is equal to 1.73, indicating a very large effect, therefore a very large difference between the initial test values and the final test values. For the control group, the effect size index \( (d) \) is equal to 1.3, which also indicates a large but lower effect than in the experimental group.

Figure 3 shows the graphical representation of the progress made by the experimental group and the control group as regards their technical level for the forehand clear.

When assessing the technical level for the backhand net lift, the experimental group achieved 4.11-point progress, averaging 7.83 points in the initial test and 11.94 points in the final test. The control group achieved a progress of 1.44 points, the average values being 6.61 points in the initial test and 8.05 points in the final test.

The coefficient of variation of 28% recorded by the experimental group in the final test indicates a relatively homogeneous dispersion around the mean of the measured data. The coefficient of variation of 32% recorded by the control group in the final test indicates a non-homogeneous dispersion of the measured data.

In the experimental group, the effect size index \( (d) \) is equal to 1.73, indicating a very large effect, therefore a very large difference between the initial test values and the final test values. For the control group, the effect size index \( (d) \) is equal to 1.26, which also indicates a large effect.

Figure 4 shows the graphical representation of the progress made by the experimental group and the control group as regards their technical level for the backhand net lift.
When assessing the technical level for the long forehand service, the experimental group achieved 4.17-point progress, the average values being 6.38 points in the initial test and 10.55 points in the final test. The control group achieved 2.38-point progress, the average values being 2.5 points in the initial test and 4.88 points in the final test.

The coefficient of variation of 42% recorded by the experimental group in the final test indicates a non-homogeneous dispersion around the measured data. The coefficient of variation of 36% recorded by the control group in the final test also results in a non-homogeneous dispersion of the measured data.

In the experimental group, the effect size index \( (d) \) is equal to 1.5, indicating a very large effect, therefore a very large difference between the initial test values and the final test values. For the control group, the effect size index \( (d) \) is equal to 1.45, which also indicates a very large effect.

Figure 5 shows the graphical representation of the progress made by the experimental group and the control group as regards their technical level for the long forehand service.

When assessing the average execution speed for the forehand clear, the progress of the experimental group was 13.83 km/h, the average values being 69.72 km/h in the initial test and 83.55 km/h in the final test. The progress of the control group was 6.61 km/h, the average values being 57.11 km/h in the initial test and 63.72 km/h in the final test.

The coefficient of variation of 21% recorded by the experimental group in the final test indicates a relatively homogeneous dispersion around the measured data. The coefficient of variation of 25% recorded by the control group in the final test also gives a relatively homogeneous dispersion of the measured data. In the experimental group, the effect size index \( (d) \) is equal to 1.26, indicating a very large effect, therefore a very large difference between the initial test values and the final test values. For the control group, the effect size index \( (d) \) is equal to 0.73, indicating a medium to large effect.

Figure 6 shows the graphical representation of the progress made by the experimental group and the control group as regards their average execution speed for the forehand clear.

Figure 5. Graphical representation of the progress made by the experimental group and the control group as regards their technical level for the long forehand service

Figure 6. Graphical representation of the progress made by the experimental group and the control group as regards their average execution speed for the forehand clear
When assessing the average speed for the backhand net lift, the progress of the experimental group was 7.16 km/h, averaging 57.61 km/h in the initial test and 64.77 km/h in the final test. The progress of the control group was 4.83 km/h, the average values being 51.44 km/h in the initial test and 56.27 km/h in the final test.

The coefficient of variation of 17% recorded by the experimental group in the final test indicates a relatively homogeneous dispersion around the measured data. The coefficient of variation of 21% recorded by the control group in the final test also gives a relatively homogeneous dispersion of the measured data.

In the experimental group, the effect size index (d) is equal to 0.84, indicating a large effect, therefore a large difference between the initial test values and the final test values. For the control group, the effect size index (d) is equal to 0.74, indicating a medium to large effect.

Figure 7 shows the graphical representation of the progress made by the experimental group and the control group as regards their average execution speed for the backhand net lift.

![Figure 7. Graphical representation of the progress made by the experimental group and the control group as regards their average execution speed for the backhand net lift](image)

In all 5 tests aimed at assessing the level of learning the technical procedures, the statistical significance threshold was reached (p < 0.05). The values of the effect size calculated by the dependent t-test, as well as their interpretation, are presented in Table 2.

<table>
<thead>
<tr>
<th>Assessment tests</th>
<th>Values and interpretations of the effect size</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forehand clear - technical level assessment</td>
<td>d = 1.73, very large effect d = 1.3, very large effect</td>
<td>0.43</td>
</tr>
<tr>
<td>Backhand net lift - technical level assessment</td>
<td>d = 1.73, very large effect d = 1.26, very large effect</td>
<td>0.47</td>
</tr>
<tr>
<td>Forehand clear - assessing the average speed of shot</td>
<td>d = 1.26, very large effect d = 0.73, medium to large effect</td>
<td>0.53</td>
</tr>
<tr>
<td>Backhand net lift - assessing the average speed of shot</td>
<td>d = 0.84, large effect d = 0.74, medium to large effect</td>
<td>0.1</td>
</tr>
<tr>
<td>Long forehand service - technical level assessment</td>
<td>d = 1.5, very large effect d = 1.45, very large effect</td>
<td>0.05</td>
</tr>
</tbody>
</table>

The assessment of the technical procedures also revealed higher values of progress in the experimental group compared to the control group for all 5 tests used (Table 2 and Table 3).
Table 3. Presentation of the progress achieved by the two groups in the assessment of the technical procedures

<table>
<thead>
<tr>
<th>Assessment tests</th>
<th>Progress of the experimental group</th>
<th>Progress of the control group</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forehand clear - technical level assessment (points)</td>
<td>4</td>
<td>2.33</td>
<td>1.67</td>
</tr>
<tr>
<td>Backhand net lift - technical level assessment (points)</td>
<td>4.11</td>
<td>1.44</td>
<td>2.67</td>
</tr>
<tr>
<td>Forehand clear - assessing the average speed of shot (km/h)</td>
<td>13.83</td>
<td>6.61</td>
<td>7.22</td>
</tr>
<tr>
<td>Backhand net lift - assessing the average speed of shot (km/h)</td>
<td>7.16</td>
<td>4.83</td>
<td>2.33</td>
</tr>
<tr>
<td>Long forehand service - technical level assessment (points)</td>
<td>4.17</td>
<td>2.38</td>
<td>1.79</td>
</tr>
</tbody>
</table>

Conclusions

In the experimental group, the assessment of the technical procedures revealed a positive development between the initial test and the final test. In all 5 tests aimed at assessing the level of learning the technical procedures, the statistical significance threshold was reached.

Given the above, the hypothesis is therefore confirmed: “The use of a 7-month training program aimed at initiating children aged 6-7 years to badminton leads to statistically significant differences between the initial and final results recorded in the technical assessment tests” (differences emphasised by the p-values and the magnitude of the effect size, denoted by $d$).

In the control group, the assessment of the technical procedures also revealed a positive development between the initial test and the final test. However, we can conclude that the use of the training program developed by us for a period of 7 months leads to greater progress between the initial tests for the technical execution and the final ones than the use of a traditional training program.

References

APPLICATIVE COORDINATION ABILITIES – STUDENT SAFETY FACTOR IN CONTEMPORARY LEISURE ACTIVITIES

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Abstract. In the modern conditions of school children’s development, it is especially relevant to increase the resistance of their bodies to both the unfavourable conditions of the economic and ecological environments, and the “consequences” of intensive technical development, which reduces their motor functions, and this is reflected in the insufficient preservation of health, low efficiency and other negative factors. The purpose of this study was to form the applicative coordination abilities of 12-13-year-old school children for the successful positioning of their development and leisure-time entertainment. Objectives and tasks of the study: identify the leisure-time features in students aged 12-13 to have an idea of their most common coordination abilities; study the morphofunctional, intellectual, psychomotor and motor specificities of 12-13-year-old school children; develop a program for the formation of applicative coordination skills in pupils aged 12-13; experimentally substantiate the effectiveness of the Applicative Coordination Development Program for 12-13-year-old school children.

During the school year and extracurricular time, training program classes were organized with 12-13-year-old school children for the development of their applicative coordination abilities in combination with theoretical training to successfully counter the negative effects of interpersonal “entertainment” relationships and natural anomalies.

Keywords: physical education, school children, coordination abilities, motor skills, teaching process.

Introduction

In the contemporary conditions of the human vital activity, the issue of increasing the resistance of organism to the unfavourable conditions of the economic environment, of the ecological environment and of the “consequences” of the intense technical development, which diminishes its motor functions, and this is reflected in the insufficient preservation of health, low efficiency and other negative factors (Artyomov, 1990; Balsevich & Lubyshcheva, 1995; Lubyshcheva, 2017; Demcenco, 2017a; Manolachi, 2017; Pelin, 2007). Particularly, the aspect of the socialization of the young generation should be emphasized, which together with the constantly developing information technologies, virtually excludes their physical activity, so necessary for a successful self-reliance in contemporary society, sometimes inadequate (Demcenco, 2017b; Lyakh, 2006, pp. 113-127). Thus, political instability, economic “tensions”, climatic changes, living conditions require to the younger’s special dexterity, active analytical thinking, applicative coordinative and motor abilities that could inspire confidence that they are safe in the extreme and unpredictable situations of the Society (Lubyshcheva, 2017; Pascan, 2011; Potop & Jurat, 2016).

Such analytical positioning and applicative motor abilities may keep young people, to a certain extent, away from foolish facts and lead them to make correct decisions in non-standard situations (Lovitsky, 2015; Chicomban, 2012). This work also refers to preadolescents aged 12-13 year-old who by virtue of the specifics of their functional-motor and psychic development, are already able to take a conscious attitude towards the created situations, to analyse them and make the right decisions, including motor character. Especially we mention that, at the contemporary stage, school physical education in the Republic of Moldova has an academic character and does not solve the applicative coordinative and motor tasks on ensuring the students safety during their free time in various cognitive and recreational situations.

That is why the formation of the applicative coordinative abilities of the 12-13-year-old students and their necessity in the contemporary society is present for the establishment of interpersonal relationships within the leisure activities, especially for the successful achievement of motor actions in unpredictable situations.

Material and methods

Participants

Two groups of students aged 12-13 years participated in the basic pedagogical research: the control group and the experimental group, 15 people in each group. In the experimental group, the teaching and training process was oriented towards the development of coordinative abilities, during the school year, covering 115 hours, 3 lessons per week, besides of the teaching hours. The control group attended physical education classes traditionally organized and included in the school curriculum. At the end of basic pedagogical research, a comparative analysis
of the results obtained at the initial and final stage of the experiment was carried out in order to assess the effectiveness of the means and methods for developing the coordination abilities of 12-13 year old students.

**Instruments**

In order to reflect the level of acquisition in the case of applicative coordinative abilities and skills of the preadolescents and in accordance with the research objectives, physical development has been studied, the cognitive component “stability of attention”, the psychomotor qualities according to the “Tapping”, “Romberg”, “Triangle”, “Stabilometry” tests, as well as the general level of motor and coordination training of the students participating in the experiment. The most current types of motor activity, which form the essential applicative coordination abilities of students, were analysed.

**Procedure**

The experimental pedagogical research involved the study of the scientific and methodological literature regarding the contemporary society and its influence on the social conditions of people, the mutual relationships between the children of school age and the contemporary social reality in the Republic of Moldova, also containing a characterisation of the respondents’ opinions (teachers and students) regarding the issue which we are interested in. Taking into account the fact that, for different reasons, objective and subjective, the students’ hypothesis dynamics is increasing ever further and the traditional system of physical education from the Republic of Moldova, in terms of content and structure, cannot cope with this situation, obviously also the recorded results at the current stage leaves much to be desired. That is why we have formulated the hypothesis regarding the need to train complex coordinative motor skills as the basis of adequate actions of the students in non-standard conditions, including in the unprecedented aggressive environment of the contemporary society.

The program for training the applicative coordination abilities of 12-13-year-old preadolescents was developed, which included the main types of coordination and motor activity and the application of the most effective means and methods of physical development.

**Results**

In the observational experiments, the functional condition specific to the age of the 12-13 year old students body was studied, and through the use of stabilometric methods, the potential of preadolescents was studied in terms of motor memory and conduction of their own movements. It was also determined the level of training the applicative coordinative abilities of the 12-13-year-old students. The results of the experiments showed that the students engaged in the experiment had a higher body weight in the physical development tests (Quetelet index - up to 0.34), and the functional ones (heart rate) showed a lack of heart contraction recovery after exercise before the initial state.

The analysis of the cognitive component “attention stability” (Bourdon-Anfimov test) highlighted a qualitatively lower level than the average. The results of psychomotor tests (Tapping, simple and complex response to sound and light signals) were inferior to the age-specific development indices. The results of the stabilometric tests of studying the ability to direct their own movements through the visual-motor and proprioceptive components, the students’ motor memory processes also proved to be insufficient for the analysed age category. The same situation was also observed in the tests for assessing the level of general training and the development of coordinative abilities. These facts reflect a low level of motor development of 12-13 year old students engaged in the pedagogical experiment.

The results of one-year basic pedagogical research confirmed an increase in the indices of the intellectual, somatic, stabilometric and coordinative-motor development of the students in the experimental group.

In terms of physical development, the body weight values of the students in the control group increased significantly, on average with 4.8 kg (p < 0.05), given the insufficient motor activity, while the experiment group achieved an intensive activity of forming the complex coordinative abilities, which increased the body weight by only 2.2 kg (p > 0.05), probably due to the increase in height, accompanied by the simultaneous reduction of the initial weight. At the same time, the Quetelet index was reduced to 0.33 in students from the experimental group, thus alleviating the initial tendency of overweight. In the chest excursion (CE) during the research period, the students from the experimental group recorded a significant superiority to the students from the control group (p < 0.001), which reflects the higher functional possibilities of the students who were actively developing.

It is known that the well-targeted motor development of students exerts a positive influence on their intellectual state, improving their cognitive components, such as perception, memory, thinking and creativity.
(Demcenco, 2017b; Pelin, 2007). At the same time, we are convinced that, among the cognitive abilities, the most important ones for solving situational motor tasks is the attention, which depends on the sensory condition and the central nervous system, whose stability and concentration determine the subsequent analytical process, and later on, perception, thinking and creativity for adopting possible motor solutions depending on the situation. The stability and attention focus of the students engaged in the experiment were assessed using the Bourdon-Anfimov test, whose results showed that the stability of the preadolescents’ attention from the experimental group increased to the end of the research from the average level to the above average level. In the control group, this index increased only to the average level of stability. The assessment in minutes of the students’ attention concentration abilities reflects a relatively stable, increasing dynamics of the fatigue state in the central nervous system in the Bourdon-Anfimov final testing stage (Figure 1).

![Figure 1. Dynamics of average values of the indices reflecting the attention focus of 12-13-year-old boys (Bourdon-Anfimov test)](image)

Table 1 presents the basic results of the research regarding the psychomotor condition of students in the two groups. Thus, in the experimental group, the results recorded in tests 1-3 significantly improved (p < 0.01) compared to the control group.

In particular, it is worth mentioning that the values of the reactions of the students from the experimental group recorded in the complex visual and motor test (up to 70%) have significantly improved. In addition, the students from the experimental group reached towards the end of the research, according to their psychomotor tests, results adequate for their age. In our opinion, this statistically significant improvement of the preadolescents’ psychomotor development in the experimental group is due to the active development of the coordination and motor abilities through the effective means and methods applied by us.
Table 1. **Comparative and contrastive analysis of the psychomotor indices of boys participating in the experiment**

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Tests</th>
<th>Statistical groups and indices</th>
<th>Initial testing</th>
<th>Final testing</th>
<th>t</th>
<th>p</th>
<th>Model results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tapping test (40 sec), nr. of rounds</td>
<td>C</td>
<td>254.00 ± 6.47</td>
<td>263.94 ± 6.44</td>
<td>1.63</td>
<td>&gt; 0.05</td>
<td>280 and less</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>260.00 ± 6.50</td>
<td>282.24 ± 6.00</td>
<td>3.76</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>t</td>
<td>0.65</td>
<td>2.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>p</td>
<td>&gt; 0.05</td>
<td>&lt; 0.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The simple sensory-motor reaction to sound (m/sec)</td>
<td>C</td>
<td>0.48 ± 0.03</td>
<td>0.46 ± 0.03</td>
<td>0.67</td>
<td>&gt; 0.05</td>
<td>0.40 and less</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>0.47 ± 0.03</td>
<td>0.37 ± 0.02</td>
<td>4.00</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>t</td>
<td>0.50</td>
<td>2.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>p</td>
<td>&gt; 0.05</td>
<td>&lt; 0.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>The simple sensory-motor response to a flare (m/sec)</td>
<td>C</td>
<td>0.44 ± 0.03</td>
<td>0.42 ± 0.03</td>
<td>0.67</td>
<td>&gt; 0.05</td>
<td>0.37 and less</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>0.42 ± 0.03</td>
<td>0.32 ± 0.02</td>
<td>4.00</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>t</td>
<td>0.50</td>
<td>2.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>p</td>
<td>&gt; 0.05</td>
<td>&lt; 0.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Complex sensory-motor reaction to a moving object (sec)</td>
<td>C</td>
<td>Initial</td>
<td>Final</td>
<td></td>
<td></td>
<td>Model values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>Real (by age)</td>
<td>Model values (by age)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Anticipation reaction “.”</td>
<td>C</td>
<td>0.82 sec till 10</td>
<td>0.56 sec till 10</td>
<td></td>
<td>-0.42 sec till 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>0.80 sec till 10</td>
<td>0.41 sec till 10</td>
<td></td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>Delayed reaction “+”</td>
<td>C</td>
<td>+ 1.07 sec from 10</td>
<td>+ 0.60 sec from 10</td>
<td></td>
<td>+ 0.35 sec from 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>55%</td>
<td>41%</td>
<td></td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>Timely reaction</td>
<td>C</td>
<td>11%</td>
<td>31%</td>
<td></td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>13%</td>
<td>70%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is particularly important to highlight the importance of research results, such as the age-based management of their own movements on the background of motor memory, taking into account the difficult motor situations that may interfere with recreational activities.

In the Stabilometry Test investigating the students’ ability to conduct their own movements in visual disturbance conditions, the experimental group showed superior results that, due to the active development of their motor coordination abilities, exceeded those of the control group at the end of the experiment.

Thus, the Stabilometry Test has demonstrated that the better the movement direction of the experimental group students is, the closer to the centre are the coordinates of the centre of gravity (CG), and thus the higher their level of physical training is (Figures 2 and 3).
In the Romberg Test, on the basis of which it was studied the visual-proprioceptive capacities of movement, it turned out that at the beginning of the investigations, in the control and experimental groups on average only 16% had the capability of complex conjugate action of the proprioceptive visual analysers’ and vestibules in directing their own centre of gravity and were successful in testing. At the same time, at the end of the research, the experimental group reached the level of visual-proprioceptive guidance of the CG of 81%, while the control group did not exceed the level of 39%.

In the Triangle Test, according to which the state of the students’ motor memory was studied, it was found that in the first and the second stage of the research, the pupils in the experimental group, due to the active coordination-motor development achieved during the school year, improved the motor memory needed for the required age criteria (Figure 4). At the same time, the control group recorded a certain increase in these indices, but they did not reach the desired level.

Note: A – 1st stage, B – 2nd stage (control group); C – 1st stage, D – 2nd stage (experimental group)
Thus, the instrumental analysis of the guidance motor abilities, which are related to the actual state of the
motor memory of the students enrolled in the study, have highlighted that these indices are superior to those
recorded by the control group due to the development of motor coordination skills, on the basis of our program.

The comparative analysis of the general physical training test results, which characterise the main physical
qualities of the pupils in the experimental groups during the reference period, revealed that the experimental
group, as a result of the coordinative-motor directional influence, recorded in all the final tests statistically
significant differences (p < 0.01) and reached the age-appropriate level. At the same time, the control group
improved insignificantly the results, which showed statistically insignificant differences (p > 0.05), determined by
the limited motor activity performed during this period of time. We mention in particular the coordination-motor
development of the students in the experimental group during the annual training cycle, as demonstrated by the
data in Table 2, which reflects the considerable improvement of the results in all the tests.

### Table 2. Comparative analysis of the test results for the specialised complex coordination skills compared to
the model values of the 12-13-years-old boys in the experimental groups during the research period

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Tests</th>
<th>Statistical groups and indices</th>
<th>Initial testing</th>
<th>Final testing</th>
<th>t</th>
<th>p</th>
<th>Model results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 × 8 m shuttle running, driving the basketball ball (sec)</td>
<td>C 12.10±0.45</td>
<td>11.70±0.43</td>
<td>0.95</td>
<td>&gt; 0.05</td>
<td>10.7 and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E 11.95±0.47</td>
<td>10.50±0.38</td>
<td>3.54</td>
<td>&lt; 0.01</td>
<td>less</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T 0.23</td>
<td>2.10</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &gt; 0.05</td>
<td>&lt; 0.05</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Long jump momentum (cm)</td>
<td>C 141.80±1.95</td>
<td>143.13±1.88</td>
<td>0.71</td>
<td>&gt; 0.05</td>
<td>148 and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E 141.23±1.92</td>
<td>148.73±1.84</td>
<td>3.88</td>
<td>&lt; 0.01</td>
<td>more</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T 0.21</td>
<td>2.13</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &gt; 0.05</td>
<td>&lt; 0.05</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Running on gymnastic beam with ball (sec)</td>
<td>C 6.10±0.34</td>
<td>5.78±0.32</td>
<td>1.03</td>
<td>&gt; 0.05</td>
<td>5 sec and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E 6.16±0.36</td>
<td>4.85±0.30</td>
<td>4.09</td>
<td>&lt; 0.01</td>
<td>more</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T 0.12</td>
<td>2.11</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &gt; 0.05</td>
<td>&lt; 0.05</td>
<td>—</td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td>Standing position, throwing the ball up, squatting, resting in the initial position, and catching the ball (no. of r. in 30 sec)</td>
<td>C 5.89±0.37</td>
<td>6.18±0.35</td>
<td>0.85</td>
<td>&gt; 0.05</td>
<td>7 times and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E 6.00±0.34</td>
<td>7.24±0.30</td>
<td>4.13</td>
<td>&lt; 0.01</td>
<td>more</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T 0.22</td>
<td>2.30</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &gt; 0.05</td>
<td>&lt; 0.05</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Throwing the medical ball (2 kg) with two hands from the chest forward (cm)</td>
<td>C 262.51±6.29</td>
<td>267.10±6.13</td>
<td>1.91</td>
<td>&gt; 0.05</td>
<td>282 and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E 265.30±6.26</td>
<td>285.46±6.00</td>
<td>3.47</td>
<td>&lt; 0.01</td>
<td>more</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T 0.31</td>
<td>2.14</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &gt; 0.05</td>
<td>&lt; 0.05</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Rolling forward-back with returns (no. of r. in 30 sec)</td>
<td>C 6.10±0.39</td>
<td>6.49±0.37</td>
<td>1.08</td>
<td>&gt; 0.05</td>
<td>7 times and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E 6.22±0.41</td>
<td>7.56±0.35</td>
<td>3.72</td>
<td>&lt; 0.01</td>
<td>more</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T 0.21</td>
<td>2.09</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &gt; 0.05</td>
<td>&lt; 0.05</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Fall backwards, rolling back and stand up (no. of r. in 30 sec)</td>
<td>C 3.25±0.50</td>
<td>3.72±0.48</td>
<td>1.02</td>
<td>&gt; 0.05</td>
<td>5 times and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E 3.40±0.50</td>
<td>5.16±0.46</td>
<td>3.91</td>
<td>&lt; 0.01</td>
<td>more</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T 0.21</td>
<td>2.19</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &gt; 0.05</td>
<td>&lt; 0.05</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Dropping the tennis ball into a vertical target (no. of successful throws from 10 attempts)</td>
<td>C 5.86±0.43</td>
<td>6.18±0.40</td>
<td>0.82</td>
<td>&gt; 0.05</td>
<td>7 times and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E 6.08±0.44</td>
<td>7.63±0.35</td>
<td>4.08</td>
<td>&lt; 0.01</td>
<td>more</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T 0.36</td>
<td>2.74</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &gt; 0.05</td>
<td>&lt; 0.05</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>One hand dribbling / ball conduct, moving on the gym bench (sec)</td>
<td>C 7.08±0.43</td>
<td>6.83±0.41</td>
<td>0.62</td>
<td>&gt; 0.05</td>
<td>6 sec and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E 6.87±0.41</td>
<td>5.53±0.36</td>
<td>4.13</td>
<td>&lt; 0.01</td>
<td>less</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T 0.27</td>
<td>2.41</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>P &gt; 0.05</td>
<td>&lt; 0.05</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>
At the same time, the results of the control group pupils in each of these tests are statistically insignificant (p > 0.05), and the pupils in the experimental group have statistically significant differences compared to initial testing (p < 0.01). Additionally, the students in the experimental group reached, at the end of the experiment, all the applied tests, the necessary, age-specific, coordinative-motor development.

Thus, the listed successes of the students in the experimental group demonstrate that the means and methods of general physical and coordinating-complex physical development planned by us in the project and subsequently realized were quite effective for the formation of their coordinative-motor skills specific to the age, applicative character in the unpredictable cognitive-recreational activities of social reality.

Conclusions

The application of the means and methods of motor development projected in the program did not negatively affect the morphological status of the students enrolled in research, but, on the contrary, contributed to the natural physiological improvement of their bodies. At the same time, in the control group, the traditional organization of physical education, which is characterised by a lack of motor activities, has led to a negative consequence, namely overweight, with obesity tendencies.

The targeted development of the complex coordination skills of the pupils in the experimental group led to a significant improvement of their qualities of attention in various socio-creative situations. The analysis of the psychomotor traits of the pupils in the study groups showed that the results of the preadolescents in the experimental group, who had intense training during the school year, increased significantly, the differences being expressed by p < 0.05, and generally corresponded to age rules, unlike the control group.

The stabilometric research methods once again confirmed, through the stability of the vertical dynamic equilibrium, the fact that the directed coordinative-motor development, with applicative nature of the students in the experimental group stimulates and develops their motor memory so necessary for the rational direction of their own movements in organized recreational activities of contemporary social reality.

The success in the motor activities of the students in the experimental group have shown that the methods and means introduced in the program developed by us, oriented towards complex and coordinated physical development and later applied, were quite effective in forming the necessary motor status specific to the age of the subjects. Possessing applicative coordination abilities is a factor of student security in recreational activities in contemporary society.

References

RECIPROCAL RELATIONSHIP BETWEEN THE GAME AND TRAINING PATTERNS IN PERFORMANCE VOLLEYBALL

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Abstract. There are many types of research in the literature on modelling the game preparation in professional volleyball, but very few have highlighted the relationship between the training pattern and the game pattern, based on the analysis of the performance behaviour of the teams in the official sports competitions. This study aims to highlight the reciprocal relationship between the training pattern and the game pattern in the female performance volleyball for the Știința Bacău team depending on the opponent’s level. This research proceeded from the hypothesis according to which the technical-tactical training during the competition period has a positive influence on the game action efficiency indices, in other words, it influences the game pattern. From this interaction we can debate on the reciprocal relationship between the game pattern and the training pattern. The 14 players of the Știința Bacău women’s volleyball team in the 2017-2018 competitive season took part in the study. As a result of this research, significant differences were recorded in the matches with the level 1 teams for the blocking and taking over game action efficiency indices, and in the matches with the level 2 teams, significant differences in the serve taking over and taking over from the attack as the game action efficiency indices, which confirms the hypothesis of our research.

Keywords: reciprocal relationship, efficiency indices, volleyball, performance, opponent’s level.

Introduction

Professional sports are about the athletes proving during competitions their capabilities in agreement with the rules and methods of the competition in a certain event (Triboi & Păcuraru, 2013, p. 60), while a competition between two individuals or multiple groups of individuals is only apparently free-form, actually having rules that give it legitimacy and due to which one side can be declared the winner (Meyer, 1976, cited by Teodorescu, 2010, pp. 17-20). Training in professional sports is performed according to certain patterns. The efficiency of the pattern, defined as the ability to reproduce the essential characteristics of the original (Bontaș, 1994, p. 143) depends on the way in which it is used, the way in which markers of the competition pattern (the official game) are converted in objectives of the training pattern.

The literature concerning the modelling of training in volleyball is vast, but very few studies have proven that there is a relationship between the game and the training pattern, based on the analysis of the players’ efficiency markers during official competitions. The modern volleyball training is based on the analysis of the relationship between the training and the game pattern, a relationship proven by highlighting the performance behaviour of the volleyball players.

This relationship is often mentioned abstractly in a debate in regard to the unity that must exist between training and competition. One of the first coaches to succeed in putting this concept into the practice of basketball was Colibaba-Evuleț (1976). He identified and applied the methodological operations of this concept.

The reciprocal relationship between the game pattern and training aims to closely observe the dynamics of the performance behaviour of the team and each player individually, using the observable components of the pattern and statistical markers. They are also common elements for both of the patterns that are discussed – the game pattern and the training pattern. Many sports (track and field, rowing, skiing, swimming, etc.) use this concept, but they call it “goal-thinking” and not “reciprocal relationship” as it is called in this paper.

According to Mărăș-Dănilă (2006, p. 24), the efficiency analysis during competitions is primary and must reflect faithfully the realities of the competition game. Knowing the efficiency is an objective need of top performance and can have an essential contribution to proving the reciprocal relationship between the training pattern and the game pattern in sports. The evaluation of the general efficiency of the game is done based on the effectiveness of each game action.

This reciprocal relationship between the training and the game pattern was proven in basketball, a relationship that must be used for the benefit of the continuous progress of the players’ capabilities and the team’s performance capacity (Colibaba-Evuleț & Șarlă, 2007).

The aim of this study is to highlight the reciprocal relationship between the training pattern and the game pattern in female performance volleyball from the Știința Bacău team depending on the opponent’s level.
The game pattern used in the training program between two competitions is influenced by the game pattern of the opposing team, which supports the reciprocal relationship between the game and the training pattern. The objectives were to highlight the level of technical-tactical training in the competition period, by analysing the game-action efficiency markers, and to emphasise the reciprocal relationship between the game and the training pattern.

This research has started from the hypothesis according to which the technical-tactical training during the competition period has a positive influence on the game action efficiency markers, in other words, it influences the game pattern. From this interaction, we can debate on the reciprocal relationship between the game pattern and the training pattern.

Material and methods

The research methods were: the bibliographical documentation method, the pedagogical observation method, the modelling method, the statistical-mathematical method, the analytical method and the graphical representation method.

Subjects and place of research

The participants of this study were 14 female players of the Ştiinţa Bacău women’s volleyball team in the 2017-2018 competition season; the team participated in the National Championship, Division A1.

The research was conducted in the Bacău Sports Hall, where the Ştiinţa Bacău women’s volleyball team trained and played its official matches, and in other Romanian halls where the women's volleyball teams participating in the National Championship, Division A1 conducted their activity during the 2017-2018 season. The Bacău Sports Hall is equipped with everything needed for conducting this study under good conditions. The research was conducted between October 2017, when the competition period started, and February 2018, when the official games of the Phase I of the National Championship, Division A1 ended.

Assessment protocol

The evaluation of the technical-tactical performance of the female players during the official games was done using the Data Volley 2007 Professional software. The information gathered during the official games with the software was introduced into Microsoft Excel, which was used to calculate the efficiency of the game actions on a scale of six levels (for serve, serve takeover, and attack takeover) and of five levels (for attack and blocking).

The scaling and encoding on six levels, used for the serve game action, is as follows: $0 = \text{Wrong (in the net, outside the court, stepping over the end line)}; 1 = \text{Negative (serve takeover of the opponent is }\#\text{ or }+\text{ and can attack with all options)}; 2 = \text{Neutral (serve takeover is }\!\!\!\!\!\!\!\text{ and the ball is taken over on the 3-meter line)}; 3 = \text{Positive (serve takeover is }\!\!\!\!\!\!\!\text{ and the attack can only be performed from a high pass)}; 4 = \text{Semi-ace (the serve takeover is weak; the ball is sent directly to the opponent's court)}; 5 = \text{Direct point (the take over is wrong }\#\text{)}$.

In order to calculate the efficiency of the serve, the following formula was used:

$$E = \frac{A+B(0.8)+C(0.6)+D(0.4)+E(0.2)}{A+B+C+D+E+F}$$

where:

- A – serve ending with a scored point, of 5 points – whose value is 1; B – semi-ace serve, of 4 points – whose value is 0.80; C – positive serve, of 3 points – whose value is 0.60; D – neutral serve, of 2 points – whose value is 0.40; E – negative serve, of 1 point – whose value is 0.20; F – wrong serve, of 0 points – with no value.

The scaling and encoding on six levels, used for the serve takeover and attack takeover game actions, is as follows: $0 = \text{Wrong (direct point for the opponent)}; 1 = \text{Semi-mistake (the serve and attack takeovers are directly in the opponent's court and the attack cannot be performed)}; 2 = \text{Negative (after the serve and attack takeovers, the attack can only be performed from a high step)}; 3 = \text{Neutral (the serve and attack takeover is within the 3-meter line area)}; 4 = \text{Positive (the attack can be performed from the serve and attack takeover, but not from all combinations)}; 5 = \text{Perfect (the attack can be performed from the serve and attack takeover, from all combinations)}$.

In order to calculate the efficiency of the serve takeover and attack takeover, the following formula was used:

$$E = \frac{A+B(0.8)+C(0.6)+D(0.4)+E(0.2)}{A+B+C+D+E+F}$$

where:
A – perfectly played actions, of 5 points – whose value is 1; B – positive played actions, of 4 points – whose value is 0.80; C – neutral played actions, of 3 points – whose value is 0.60; D – negative played actions, of 2 points – whose value is 0.40; E – semi-wrong actions, of 1 point – whose value is 0.20; F – lost actions, of 0 points – with no value.

The scaling and encoding on five levels, used for the attack and blocking game actions, is as follows: [0 = “=” and “/” = Wrong (direct point for the opponent); 1 = “-” = Negative (playing unfavourably for one’s own team); 2 = “!” = Neutral (playing the ball through indecisive actions); 3 = “+” = Positive (playing the ball favourably to one’s own team); 4 = “#” = Point (winning attack or blocking)].

In order to calculate the efficiency of the attack and blocking, the following formula was used:

$$E = \frac{A+B+0.75C+0.50D+0.25E}{A+B+C+D+E},$$

where:

A – actions ended with a win, of 4 points – whose value is 1; B – positive played actions, of 3 points – whose value is 0.75; C – neutral played actions, of 2 points – whose value is 0.50; D – negative played actions, of 1 points – whose value is 0.25; E – lost actions, of 0 points – with no value.

Results

In order to prove the reciprocal relationship between the training and the game model, a comparative analysis between the game models from the 2016-2017 and the 2017-2018 season was conducted, on the level-1 teams, for 10 games per season.

In regard to the level-2 teams, the paired samples Student’s t-test was used for analysis 8 of the 12 games in the season 2016-2017. The selection was done taking into account the final ranking of the season, eliminating the relegated teams.

By constantly monitoring the parameters of the proposed game models during the Știința Bacău’s official games, the authors managed to conduct a comparative analysis of the results based on the efficiency coefficients recorded during the two seasons, according to the opponent’s level.

By analysing the data from the final game model and the data from the initial one, the authors could evaluate and highlight the behaviour of Știința Bacău, based on its training and the performance during the official games of the efficiency markers on each game action of the team.

The data in Table 1 represents average values of the game model, for each action composing this model for the level-1 teams, reflecting their average efficiency during the official competitions, recorded by Știința Bacău during Phase I of the National Championship, Division A1, in the two seasons.

Table 1. Results of the Student’s t-test for paired samples (* = p < 0.05)

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>2016-2017 Average</th>
<th>Std. dev.</th>
<th>2017-2018 Average</th>
<th>Std. dev.</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serve</td>
<td>0.420</td>
<td>0.03</td>
<td>0.405</td>
<td>0.02</td>
<td>1.502</td>
<td>0.167</td>
</tr>
<tr>
<td>Serve takeover</td>
<td>0.610</td>
<td>0.04</td>
<td>0.618</td>
<td>0.05</td>
<td>-0.311</td>
<td>0.763</td>
</tr>
<tr>
<td>Offense</td>
<td>0.578</td>
<td>0.05</td>
<td>0.576</td>
<td>0.06</td>
<td>0.092</td>
<td>0.929</td>
</tr>
<tr>
<td>Blocking</td>
<td>0.415</td>
<td>0.04</td>
<td>0.482</td>
<td>0.08</td>
<td>-2.345</td>
<td>0.044*</td>
</tr>
<tr>
<td>Attack takeover</td>
<td>0.325</td>
<td>0.09</td>
<td>0.401</td>
<td>0.03</td>
<td>-2.279</td>
<td>0.049*</td>
</tr>
</tbody>
</table>
Table 1 and Figure 1 highlight the following:

- The average efficiency of the serve was smaller in season 2017-2018, with a value of 0.405, than in season 2016-2017, when it recorded a value of 0.420;
- The average efficiency of the serve takeover was higher in season 2017-2018, with a value of 0.618, than in season 2016-2017, when it recorded a value of 0.610, with a progress of 0.008;
- The average efficiency of the attack was smaller in season 2017-2018, with a value of 0.576, than in season 2016-2017, when it recorded a value of 0.578;
- The average efficiency of blocking was higher in season 2017-2018, with a value of 0.482, than in season 2016-2017, when it recorded a value of 0.415, with a progress of 0.067;
- The average efficiency of the attack takeover was higher in season 2017-2018, with a value of 0.401, than in season 2016-2017, when it recorded a value of 0.325, with a progress of 0.076.

The Student’s t-test for paired samples was used to emphasise the significance of both the progress and results. The null hypothesis was that the technical-tactical training of professional teams during the competition period does not influence the efficiency markers of the game actions (from a mathematical standpoint, there are no significant statistical differences between the average values of the groups in the two seasons).

After analysing the results in Table 1 regarding the average differences between the two seasons of the game action efficiency, we can state the following:

- There are no significant statistical differences between the average values recorded during the two seasons, regarding the efficiency of the serve, serve and attack takeover (p > 0.05);
- In regard to the efficiency of blocking, the test reveals a significant difference between the average values recorded during the two seasons (p < 0.05); it can be said with a probability of 95% that the results are not random, and are influenced by the training - the null hypothesis is rejected;
- In regard to the efficiency of the attack takeover, the test reveals a significant difference between the average values recorded during the two seasons (p < 0.05); we can say that the results are not random, and are influenced by the training (null hypothesis is rejected).

The data in Table 2 represents average values of the game model for each action composing this model for the level 2 teams, reflecting their average efficiency during the official competitions, recorded by Știința Bacău during Phase I of the National Championship, Division A1, in the two seasons.
Table 2. Results of the Student’s t-test for paired samples – level-2 teams (* p < 0.05)

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>2016-2017 Average</th>
<th>Std. dev.</th>
<th>2017-2018 Average</th>
<th>Std. dev.</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serve</td>
<td>0.436</td>
<td>0.05</td>
<td>0.443</td>
<td>0.05</td>
<td>-0.327</td>
<td>0.753</td>
</tr>
<tr>
<td>Serve takeover</td>
<td>0.553</td>
<td>0.02</td>
<td>0.599</td>
<td>0.04</td>
<td>-2.870</td>
<td>0.024*</td>
</tr>
<tr>
<td>Offense</td>
<td>0.619</td>
<td>0.04</td>
<td>0.641</td>
<td>0.04</td>
<td>-1.089</td>
<td>0.312</td>
</tr>
<tr>
<td>Blocking</td>
<td>0.451</td>
<td>0.09</td>
<td>0.499</td>
<td>0.08</td>
<td>-0.879</td>
<td>0.409</td>
</tr>
<tr>
<td>Attack takeover</td>
<td>0.392</td>
<td>0.06</td>
<td>0.489</td>
<td>0.07</td>
<td>-2.446</td>
<td>0.044*</td>
</tr>
</tbody>
</table>

Figure 2. Compared efficiency on game actions of the Știința Bacău team - level 2 teams

Table 2 and Figure 2 highlight the following:

- the average efficiency of the serve was higher in season 2017-2018, with a value of 0.443, than in season 2016-2017, when it recorded a value of 0.436;
- the average efficiency of the serve takeover was higher in season 2017-2018, with a value of 0.599, than in season 2016-2017, when it recorded a value of 0.553, with a progress of 0.046;
- the average efficiency of the attack was higher in season 2017-2018, with a value of 0.641, than in season 2016-2017, when it recorded a value of 0.619;
- the average efficiency of blocking was higher in season 2017-2018, with a value of 0.499, than in season 2016-2017, when it recorded a value of 0.451, with a progress of 0.067;
- the average efficiency of the attack takeover was higher in season 2017-2018, with a value of 0.489, than in season 2016-2017, when it recorded a value of 0.392, with a progress of 0.097.

After analysing the results in Table 2, regarding the average differences between the two seasons of the game action efficiency, we can state the following:

- there are no significant statistical differences between the average values recorded during the two seasons, regarding the efficiency of the serve, attack, and blocking (p > 0.05);
- in regard to the efficiency of the serve takeover, the test reveals a significant difference between the average values recorded during the two seasons (p < 0.05); we can say with a probability of 95% that the results are not random, and are influenced by the training - the null hypothesis is rejected;
- in regard to the efficiency of the attack takeover, the test reveals a significant difference between the average values recorded during the two seasons (p < 0.05); it can be said that the results are not random, and are influenced by the training (the null hypothesis is rejected).
The results presented in this study show that during the 2017-2018 season the average value of the efficiency markers recorded a progress in the level 1 matches, for the following: serve takeover, blocking, and attack takeover; and in the level 2 matches, for all the five game actions.

Conclusions

At the end of the comparative analysis of the results recorded during the two seasons for the Știința Bacău team, the following can be said:

- significant differences were recorded in the matches with the level-1 teams in the two seasons for the blocking and attack takeover game actions efficiency markers;
- significant differences were recorded in the matches with the level-2 teams in the two seasons for the serve takeover and attack takeover game actions efficiency markers.

In conclusion, it can be said that the hypothesis according to which the technical-tactical training during the competition period has a positive influence on the game action efficiency markers, in other words, it influences the game pattern was confirmed. This highlights the relationship between the training and the game pattern in the Știința Bacău women’s volleyball team, based on the analysis of the efficiency markers that compose the game pattern. These efficiency markers influence the training pattern, which in its turn will influence the game pattern in the following match, according to the level of the opposing team. This relationship between the game and training pattern can be said to be reciprocal, because they influence each other, meaning the game pattern influences the training pattern, and the training pattern influences the game pattern.

References

CHARACTERISTICS OF THE TECHNICAL-TACTICAL AND PHYSICAL TRAINING OF ÉPÈE FENCERS AGED 8 TO 10 YEARS

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Abstract. The purpose of this paper is to investigate the level of technical-tactical and physical training of the fencer (épée fencer) aged 8 to 10 years. The study was conducted within the épée training group of « Quarto » Sports Club, in the fencing gym of « Steaua » Club throughout the competitive year 2016-2017, with a group formed of 10 athletes of 8 to 10 years old. The results of the study point out the degree of somatic development, the improvement of the specific physical and technical-tactical indicators and the raising of the performance level. The higher values of the capacity for performance were highlighted by athletes in two national competitions where the number of victories in groups tour increased (p < 0.01), the number of made touches increased by 2.5 (p < 0.001), the received touches decreased by 5.1 (p < 0.001), the direct elimination victories increased by 0.5 (p > 0.05) and the obtaining of the direct result during competitions decreased by 2.8 points (p > 0.05). The higher value of these indicators proves the tight connection between the physical training and the technical-tactical one during the fencing sessions. This connection is scientifically argued by the correlational analysis of the investigated indicators. In this sense we can state that by ensuring an adequate level of the technical-tactical and physical training with the help of the most important means we contributed to the achievement of better performances in competitions.

Keywords: fencing, physical training, technical-tactical training, performance.

Introduction

For successful fencing, one must be prepared from all points of views: physical, technical, tactical and psychological (Tüdös, 2000). In this respect, coaches also include them in the training sessions, the group exercises, the study and competition assaults teaching us the same thing: fencing (Ionescu, 1979). Obtaining sports results and increasing them in the future depend not only on the level of physical, technical and tactical training, but also on the motivation and will of the fencer.

The motor skills necessary for acquiring the sports mastery in fencing are the speed, dexterity, strength, ability, spring, endurance, sense of distance, simple and complex reaction time (Bompa, 2001). During the preparation of the young fencing practitioner, this training stage (8 to 10 years) is characterized by a large volume mainly dedicated to the primary physical and technical training. A fencing training session generally includes exercises for warming up, mobility and stretching, guided or individual displacements, assaults, one on one lessons and closing. But some sessions can include physical training only and/or specific physical training (Poenaru & Ceortea, 2001; Stoma, 1984).

The results of the athlete and the level he can reach depend on the physical, tactical and technical training and the will of the fencer. The specific technical and tactical training starts with the acquisition of the offensive actions (Zbigiew & Zbigiew, 2008). In order to start learning and improving the offensive actions, the athlete must have well-grounded knowledge and skills. In its essence, the tactic reflects the capacity of the athlete to intelligently use the means provided by the technique and the combat sports rules to win victory (Poenaru, 2002). Both technique and tactics are subject to the same laws of learning and improvement. If the main objective of the technical training is the motor automatism, then the objective of the tactic is to develop the sense of combat and the creative thinking of the athlete (Ionescu, 1998). The theoretical approach to fencing only by explanatory description of the technique, tactics and regulations of the International Federation is a phase already out-dated in the history of the sport with cold weapons (“Istoria Sportului Românesc: Scrimă”, 2017).

Purpose of the paper: investigation of the technical-tactical and physical training level specific to the épée fencer of 8 to 10 years old, using the indicators of the fitness tests to which the subjects were submitted.

Paper hypothesis: we believe that better performances will be achieved in competitions if a proper level of technical-tactical and physical training is provided by using the most important means.
Material and methods

Participants

This study was carried out with a number of 10 male and female (5 male and 5 female) athletes of 8 to 10 years old, belonging to the Fencing Sports Club (Épée department).

Procedure

The study was conducted within the (épée) training group of « Quarto » Sports Club, in the fencing gym of « Steaua » Club during the competitive year 2016-2017. The subjects consented to collaborate all along the study period, as well as the other subjects of the experimental study who were enrolled in other clubs. The tasks of the study were to monitor both physical and technical-tactical evolution of each subject. We selected the necessary exercises meant to help the development of the athletes and we monitored the evolution of the épee fencers with a view to obtain good results in the near and long term future.

The first testing took place in Bucharest, during the “Stebal Cup” competition on 2 -3 June 2016 and the final testing was in Bucharest too, in the 4th edition of “Stebal Cup” on 1-2 June 2017. We mention that the same athletes participated in the competition.

The basic training, the application of the training means and the training sessions content consisted in physical training workouts and exercises, using: a) exercises for the development of speed, strength, endurance, muscular flexibility and joints mobility; b) exercises and workouts for technical-tactical training, using specific variants of displacements, exercises with partner, work in pairs: simple attacks and compound attacks; c) one on one lessons and d) free assaults (of 5 or 8 touches).

Physical fitness tests and technical-tactical tests as well have been used during this study in order to determine the level of complex training of the athletes.

Anthropometric data: Height (H, cm), Weight (W, kg), Length of the upper limbs (LUL, cm), Full arm span (FAS, cm) and Length of lower limbs (LLL, cm).

Physical fitness tests (PFT): standing long jump (SLJ, cm), spring (D, cm), abdominal strength (AS) and length of lunge from squat (LS, cm).

Technical and tactical training (T-TaT): direct attack (DA, reps), attack with disengagement (AwD, reps), parry - riposte (PR, reps), compound attack (CA, reps).

Performance capacity (PC): results obtained in the Competition I (C I) and Competition II (C II).

Results

Tables 1, 2, 3 and 4 show the results of the tests in the initial and final stage of the research regarding the descriptive statistical and comparative indicators (t, p) of the anthropometric measurements, physical training, technical-tactical training and the performance capacity.

Table 1. Results of the anthropometric measurements

<table>
<thead>
<tr>
<th>Statist. Indicators</th>
<th>H (cm)</th>
<th>G (kg)</th>
<th>AVG (cm)</th>
<th>LMS (cm)</th>
<th>LMI (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>Final</td>
<td>Initial</td>
<td>Final</td>
<td>Initial</td>
</tr>
<tr>
<td>Mean</td>
<td>133.9</td>
<td>139.0</td>
<td>33.1</td>
<td>35.5</td>
<td>136.0</td>
</tr>
<tr>
<td>SD</td>
<td>5.91</td>
<td>6.27</td>
<td>3.21</td>
<td>3.75</td>
<td>6.09</td>
</tr>
<tr>
<td>CV%</td>
<td>4.42</td>
<td>4.51</td>
<td>9.71</td>
<td>10.56</td>
<td>4.47</td>
</tr>
<tr>
<td>T</td>
<td>10.58</td>
<td>7.06</td>
<td>7.36</td>
<td>16.00</td>
<td>7.67</td>
</tr>
<tr>
<td>p-values</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note: Mean – arithmetical mean; SD – standard deviation; CV% – coefficient of variations; t-parametric test Paired Comparison for Means; H – Height, W – Weight, FAS – Full arm span, LUL – Length of upper limbs, LLL – Length of lower limbs

The results of the statistical-mathematical analysis (Table 1) concerning the anthropometric data of the subjects of the research highlight an increase of the values in final testing as follows: height by 5.1 cm; weight by 2.4 kg; full arm span by 3.3 cm; upper limbs length by 2.8 cm and lower limbs length by 4.6 cm; there are significant differences at p < 0.001.
As for the results of the physical training of the épée fencers aged 8 to 10 years (Table 2), these ones reveal, in final testing, the increase of lower limbs strength by 6.5 cm in standing long jump and by 3.7 cm in vertical jump; the increase of the abdominal strength by 4.5 reps and the increase of lower limbs strength in lunge length by 2.6 cm; significant differences were found out between tests at \( p < 0.001 \).

Table 3. Results of technical-tactical training

<table>
<thead>
<tr>
<th>Statistical Ind.</th>
<th>T-Ta1 - DA (no. of reps)</th>
<th>T-Ta2 - AwD (no. of reps)</th>
<th>T-Ta3 - PR (no. of reps)</th>
<th>T-Ta4 - CA (no. of reps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>10.1</td>
<td>6.0</td>
<td>8.4</td>
<td>6.9</td>
</tr>
<tr>
<td>SD</td>
<td>3.45</td>
<td>4.44</td>
<td>2.87</td>
<td>2.37</td>
</tr>
<tr>
<td>Cv%</td>
<td>34.12</td>
<td>35.13</td>
<td>34.23</td>
<td>34.47</td>
</tr>
<tr>
<td>T</td>
<td>8.86</td>
<td>6.28</td>
<td>10.06</td>
<td>5.31</td>
</tr>
<tr>
<td>p-value</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note: T-Ta1-4 – fitness tests for technical-tactical training; DA – direct attacks; AwD – attacks with disengagement; PR – parry; CA – compound attacks

Regarding the results of the technical-tactical training of the épée fencers aged 8 to 10 years (Table 3), the final testing reveals the following increases: the number of direct attacks increased by 7.5 reps, the attacks with disengagement by 5.7 reps, parry-riposte attacks by 6.0 reps and compound attacks by 5.5 reps; there are significant differences at \( p < 0.001 \).

Table 4. Results of performance capacity

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.6</td>
<td>4.3</td>
<td>22.4</td>
<td>16.8</td>
<td>11.7</td>
</tr>
<tr>
<td>SD</td>
<td>1.26</td>
<td>1.16</td>
<td>26.71</td>
<td>4.16</td>
<td>4.27</td>
</tr>
<tr>
<td>Cv%</td>
<td>35.14</td>
<td>26.96</td>
<td>23.07</td>
<td>24.75</td>
<td>36.49</td>
</tr>
<tr>
<td>T</td>
<td>4.58</td>
<td>5.24</td>
<td>7.38</td>
<td>2.24</td>
<td>1.98</td>
</tr>
<tr>
<td>p-value</td>
<td>0.001</td>
<td>0.001</td>
<td>0.000</td>
<td>0.052</td>
<td>0.078</td>
</tr>
</tbody>
</table>

Note: V.T. - victories in groups tour; TM - touches made; T.R. - touches received; D.E.V. - direct elimination victories; R. - direct result in competition; C1 - the first competition; C2 - the second competition

In terms of performance capacity level recorded by the athletes who participated in the two national competitions (Table 4), one can notice the increase by 0.7 of the victories in groups tour (\( p < 0.01 \)), the increase by 2.5 of the touches made (\( p < 0.001 \)), the decrease by 5.1 of the touches received (\( p < 0.001 \)); the increase by 0.5 of the direct elimination victories (\( p > 0.05 \)) and the decrease by 2.8 points in the obtaining of the direct result in competitions (\( p > 0.05 \)).

Figure 1 shows the results of the correlation between the indicators of the technical-tactical training and the indicators of the physical training in initial and final testing.
The correlation between the indicators shown in Figure 1 highlights 32 correlations (16 in initial testing and 16 in final one), significant correlations at $p < 0.01$ between T-TaT3 and PF1 in initial testing ($R = 0.82$) and at $p < 0.05$ in initial testing between T-TaT1 and PF2 ($R = 0.66$), T-TaT3 and PF2 ($R = 0.63$), PF4 ($R = 0.72$); T-TaT4 and PF3 ($R = 0.64$), while in final testing between T-TaT1 and PF1 ($R = 0.65$), PF2 ($R = 0.64$), PF3 ($R = 0.76$) and PF4 ($R = 0.64$); between T-TaT2 and PF1 ($R = 0.68$), PF2 ($R = 0.64$) and PF4 ($R = 0.63$); between T-TaT3 and PF1 ($R = 0.69$) and PF4 ($R = 0.67$).

Figure 2 presents the results of the correlation between the indicators of the performance capacity and the indicators of the technical-tactical and physical training in initial testing and final testing.

The correlation between the indicators presented in Figure 2 reveals 80 correlations (40 in initial testing and 40 in final testing), significant correlations at $p < 0.001$ between CP1 and T-TaT1 in initial testing ($R = 0.90$) and in final testing ($R = 0.91$); at $p < 0.01$ between CP2 and T-TaT1 in final testing ($R = 0.85$); at $p < 0.05$ between CP1 and T-TaT3 ($R = 0.66$) and T-TaT4 ($R = 0.65$) in initial testing and between CP1 and PF3 ($R = 0.71$) and T-TaT3 ($R = 0.66$) in final testing; between CP2 and T-TaT3 ($R = 0.69$) and T-TaT4 ($R = 0.64$) in final testing; between CP3 and T-TaT1 ($R = 0.74$) in final testing; between CP4 and T-TaT1 ($R = 0.69$) in final testing; between CP5 and T-TaT1 ($R = 0.68$) in final testing.

Discussions and conclusions

In the case of the fencers, some specialised perceptions are developed due to long time practicing. The names given in fencing to these specialised perceptions are the “sense of distance”, the “sense of the blade”, the “sense of tempo”, and “the sense of rhythm”. Joined together, all these „senses“ form the „tactical sense of fight“ which is different in each fencer (Stoma, 1984).

The literature has studies that highlights various aspects related to the following matters: testing of performance fencers (Tsolakis, Kostaki, & Vagenas 2010): physiological and psychological features of the athletes...
and prevention of accidents in fencing sport (Roi & Bianchedi, 2008); biomechanical characteristics in fencing (Chen et al., 2017), etc.

The analysis of the individual test sheets pointed out the improvement of the specific physical and technical indicators, as well as a higher performance level reached in competitions. The higher values of these indicators show the close connection that exists between the physical training indicators and the technical-tactical training indicators in the fencing training sessions. The results of the correlation reveal the significant relationship between the indicators of the physical training, technical-tactical training and performance capacity. The workouts for general physical development exert an influence upon the improvement of the technical procedures.

We observed that the values of the technical-tactical tests and the competition results improved differently in each athlete. The reason of this fact is the physical and technical exercising during the training sessions but also the temperament type of each fencer. The exercises used in the training sessions and especially the genetic endowment of the athletes influence the technique, tactics and competition results. Ensuring an adequate level of the physical and technical-tactical training with the help of the major means resulted in better performances in competitions, which validates the hypothesis proposed by this research.

Acknowledgements

This study is included in the subject matter of the doctoral thesis of the first author from the State University of Physical Education and Sport of Chișinău, Moldova. We also express our gratitude to the athletes and to Missis Popa Simona Georgiana as well – coach of “Quarto” Sports Club of Bucharest – for their help in this study.

References

PERFORMANCE SPORTS EDUCATION: A SURVEY IN THIRTEEN EUROPEAN COUNTRIES

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Abstract. Performance sports education has a long tradition in Romania, and now, at pre-university level it is developed in schools with integrated sports program or in schools with additional sports program - called school sports clubs (CSS). Due to the fact that CSS are in the same time schools and sports structures, registered both in the school networks at the local (county) administrative level, but also in the sports registers administered by the line ministries, they represent a peculiar typology within the Romanian pre-university system. This paper aims to provide an overview over the findings that we get developing a survey on European level (by means of Eurydice network) to identify organizations inside the pre-university education systems that in the same time are sports structures and are devoted to performance sports activities. Our present approach is in line with the initial definition of sport, issued by the Council of Europe, which sends to physical activities in organized contexts and getting results in all type of competitions and will fill in a gap, providing information regarding performance sports education at pre-university level. The limits of this research are given by the fact that it refers only to the educational systems in thirteen European states - Austria, Czech Republic, Finland, France, Germany, Greece, Italy, Norway, Poland, Romania, Spain, United Kingdom - England, Wales and Northern Ireland and United Kingdom – Scotland.

Keywords: performance, school sports clubs, performance sports education.

Introduction

What are sport and performance? What is the meaning of these two concepts? And what is sport performance?

Sport can be seen as a complex activity involving two or more opponents, assuming a psychophysical effort made by competitors who are part of associations organized at a formal level (Predoiu, 2016, p. 9). Sport, defined also as “all forms of physical activity which, through casual or organized participation, aim at expressing or improving physical fitness and mental well-being, forming social relationships or obtaining results in competition at all levels” (Council of Europe, 2001) has a recognized social and economic impact that grown considerably over the last two decades. That is why, at European level, sport was subject of: (1) a series of public opinion surveys (i.e. Eurobarometer on Sport and Physical Activity in 2003, 2004, 2010, 2014 and 2018); (2) recommendations regarding policies and activities that mainstream and support it into other EU’s policies such as health, youth, citizenship, education and training, employment, social inclusion and social integration, research, regional development (i.e. White Paper on Sport in 2007); (3) working plans for developing a framework of European cooperation in the field of sport between policy makers, sport organizers and competent international bodies and for developing activities devoted to the societal role of sport, its economic dimension and its organization or integrity (i.e. “Pierre de Coubertin” action plan in 2007, EU Work Plan for Sport 2011-2014, 2014–2017 and 2017–2020). Much more, in 2006 the European Commission set up the EU Working Group “Sport and Economics” which developed “the Vilnius definition for sport” to identify economic activities in goods and services associated with sport. This is way, the Vilnius definition for sport (set in the context of an economic analysis) uses a three-stage approach (Eurostat, 2008): (1) a statistical definition (that corresponds to NACE code 93.1 “Sport activities”), (2) a narrow definition (that includes the statistical definition and all activities which provide inputs to sport, meaning all industries which produce goods that are necessary to perform sport) and (3) a broad definition (that includes the narrow definition and activities for which sport is an input, such as television broadcasting, hotels accommodating guests doing sport, etc.).

Starting from these definitions, two main approaches to sport could be identified – one is social and one is economic – and, in the last decade, they have been broadened and enriched through: (1) networks of social scientists, statisticians, researchers and other professionals in sport, like MEASURE (Meeting for European Sport Participation and Sport Culture Research) or COMPASS (Community of Providers of Physical Activity and Sports) that have been created and that have discussed and analysed different sport structures, responsibilities of stakeholders, financial issues, sport participation as well as elite sport structures; or, (2) harmonized statistics on sport, like Sport Statistic - Compact guides, 2016 edition (Eurostat, 2016) and Sport Statistic - Compact guides, 2018 edition (Eurostat, 2018), that have been initiated and continue to be disseminated in order to strengthen the evidence base for sport and secure evidence-based policies in this field, especially regarding its economic dimension, but also regarding physical activity to promote health, European Week of Sport initiative and...
Erasmus+ Sport program. Also, the prospects for sport have been diversified, through new insights such us: (1) volunteering activities in sport, since volunteers are central to many sport programs and sport clubs, acting in a variety of positions, including management ones – in this respect a valuable contribution being added by Hallmann and Fairley, editors (Hallmann & Fairley, 2018) that examined the cultural environment in which volunteering takes place, so that sport and event managers understand the motives and experiences of volunteers in order to effectively recruit, retain, and manage them; or, (2) social responsibility in sport organizations, since sport constitutes “an important enabler of sustainable development” (United Nations, 2015 - Transforming our world: the 2030 Agenda for Sustainable Development, Resolution 70/1 adopted by the General Assembly on 25 September 2015) – in this respect a valuable contribution being added by Smith and Westerbeek (Smith & Westerbeek, 2007), that summarised the multiple aspects concerning the social responsibility of sport, and by Valeri (Valeri, 2019), that analysed corporate social responsibility – CSR – and reporting applied to the sports world (reviewed CSR strategies and CSR reporting tools adopted by different types of sports organizations), with particular attention to the Italian reality.

On the other hand, performance means “how well a person, machine, etc. does a piece of work or an activity” (according to Cambridge Dictionary), or in business terms “the accomplishment of a given task measured against preset known standards of accuracy, completeness, cost, and speed; in a contract, performance is deemed to be the fulfillment of an obligation, in a manner that releases the performer from all liabilities under the contract” (according to Business Dictionary).

Putting them together – sport and performance – it would result at a first level, the quantification and the measurement of sport participation; this prospect is shared by Dragnea et al. as they describe sport performance as an individually or collectively valuable result, obtained in a sports competition and expressed in figures, using the system of official places or the ranking (Dragnea et al., 2006, p. 7). Yet, a deeper view is needed in order to capture the domain’s specificities, as sports performance (Epuran, Holdevici, & Tonita, 2001) is dependent on a series of skills not only from the psychic sphere, but also from a somatic, physiological, nervous, and endocrine level. According to World of Sports Science, sport performance is “a complex mixture of biomechanical function, emotional factors, and training techniques. Performance in an athletic context has a popular connotation of representing the pursuit of excellence, where an athlete measures his or her performance as a progression toward excellence or achievement”, prospect partially shared by Teodosescu as long as he describe sport performance as the motor performance realized in an institutionalized context of social comparison, but who involves inequality in the distribution of rewards (Teodosescu, 2009).

Sport performance has been and still is the subject of many approaches, in terms of: (1) performance analysis, a discipline of sports science that overlaps with physiology, coaching science, psychology, talent identification and sports medicine due to the fact that performance analysis investigations take under consideration divers aspects of performance (physical, tactical, technical or behavioural); in this respect a valuable contribution was added by O’Donoghue (2010), presenting a series of quantitative and qualitative methods that can be applied in performance analysis within different broad types of research, using data recorded during actual sports competitions; or, (2) nutrition, due to the recognition of the extremely important role of nutrition in the training programs of athletes and in their preparation for competition; in this respect a valuable contribution was added by the Medical Commission of International Olympic Committee who developed two Encyclopaedia of Sports Medicine (Maughan, 2000, 2014) devoted to Sports Nutrition.

In Romania, performance sports education is developed in schools with integrated sports program or with additional sports program. Schools with additional sports program are called school sports clubs and are only state-owned (public institutions). Their role is to select, prepare and promote students in performance sports activity (therefore they have a specific framework plan and school curricula on sports disciplines), addressing generally high school students, 14-18-year-old (however, for the beginner groups, children from 5 years old may be enrolled). School sports clubs are a peculiar typology within the Romanian pre-university system, being in the same time schools and sports structures, registered both in the school networks at the local (county) administrative level, but also in the sports registers administered by the line ministries; therefore, they have relationships with both the educational system and the sports system. For participating in competitions of national sports federations, school sports clubs register within the Sports Register and join the national sports federations. At the same time, students enrolled in the performance groups are also enrolled in the National Register of Sports Performances based on the regulations approved by Order of the Minister of Education. Currently, there are 102 school sports clubs in Romania, out of which 68 have legal personality and 34 are structures attached to other school organizations; generally, they represent about 1% of all public schools with legal personality.
Focusing on school sports clubs, it is necessary to understand their position within the Romanian pre-university education system, among other organizations involved in performance sport system. In our vision, the Church Model of Sport (Scheerder et al., 2011, p. 8) captures properly our national specificities and organizational roles on the path of sports performance. At the bottom, the main body of the church is formed by (1) schools and sport NGO’s representing “participation sport” and by (2) schools with integrated sports program representing “performance sport”; they both are responsible for the largest portion of the active sport participation for performance, but the tower of the church is built on a limited part on the “performance sport” basis – due to the context’s pressure which lead, at some schools with integrated sports program, that the performance to be identified with participation. The tower of the church is formed by (3) school sports clubs, representing “high level competitive sport” and by (4) centres of excellence representing “elite sport”. Figure 1 presents the organizational roles in pre-university education on the path of sports performance using the Church Model of Sport.

Figure 1. Organizational roles on the path of sports performance using the Church Model of Sport

Starting from our national specificities, namely the existence of sports training institutions that are in the same time schools and sports structures and that are devoted to performance sports activities, we tried to identify similar organizations in the European area, in order to outline management factors favourable to sport performance at the pre-university level. Analysing the paper work “Comparative Sport Development. Systems, Participation and Public Policy” (Hallmann & Petry, 2013), a result of MEASURE network efforts to provide an overview of perspectives and approaches to sports development, we found valuable insights regarding sport systems, financing of sport, public policy towards sports, and sport participation but no information regarding schools and/or sports structures inside the educational system (pre-university level) devoted to performance sports activities.

So, this paper aims to provide an overview over the findings that we get developing a survey on European level (by means of Eurydice network) to identify organizations inside the pre-university education system that in the same time are sports structures and that are devoted to performance sports activities. In other words, this present paper will provide answers to the following questions – “Which organizations inside the European pre-university education systems are responsible for sports training?” and “Is the training program developed by these organizations devoted to sport performance?” Under these auspices, our present approach is in line with the initial definition of sport, issued by the Council of Europe, which sends to physical activities in organized contexts and getting results in all type of competitions and will fill in a gap, providing information regarding performance sports education at pre-university level.

**Research methodology**

Methodologically, in June 2018 it was developed a questionnaire with four items, which was sent (via Romanian Eurydice unit) to all the Eurydice national units forming the Eurydice network means, to 42 Eurydice national units in 38 countries participating in the Erasmus + program (the 28 member countries of the European
Union, Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Iceland, Liechtenstein, Montenegro, Norway, Serbia, Switzerland and Turkey).

First of all, these items were meant to identify organizations that offer sport training programs inside regular taught time, as organizations offering extracurricular activities that complement or extend the scope of physical activities could be identified in chapter 6 of Eurydice report “Physical Education and Sport at School in Europe” (EACEA, Eurydice and Policy Support, 2013). Secondly, these items were meant to deepen first line of information, respectively to identify national strategies which target these organizations or include them and the relationship between organizational performance and sport performance of children/pupils. These items were as follows: Q1—“In what forms and institutions is sports training organized for children and pupils aged 5-19?”; Q2—“How many of these institutions are operating and how are they funded?”; Q3—“If there is a strategy for the development of sport at national level, what are the lines provided for these institutions?”; Q4—“How are the results obtained by these institutions evaluated? What is the relationship between the performance of the sports training institution and the sport performance?”. However, the present paper is focusing only on the information gathered through the first two items—Q1 and Q2—and on the qualitative analysis that derives from the responses received from 12 Eurydice national units (in alphabetical order): Austria, Czech Republic, Finland, France, Germany, Greece, Italy, Norway, Poland, Spain, United Kingdom – England, Wales and Northern Ireland and United Kingdom – Scotland. The rest of the Eurydice national units did not respond to our request.

Results

Qualitative analysis of the information provided shows, on the one hand, that physical education represents a point of interest in all the above 12 states, but on the other hand that there is no similar approach in terms of performance sports, what was to be expected, given the European sports policies and the principle of subsidiarity that allows Member States to keep their authority in certain areas, including education. The differences are considerable: (1) in some states (Germany, Hellenic Republic, United Kingdom - England, Wales and Northern Ireland) there are no pre-university educational organizations dedicated to performance sport; (2) not always the educational sector is responsible for organizing sports activities in schools, as in the case of Norway, and in some cases, a collaboration was identified between the educational sector and the sports sector, as in the case of Austria; (3) private initiative is more or less present, in terms of private schools dedicated to performance sport. Table 1 presents the summary of the data received to the first two items in the questionnaire.

Table 1. The summary of the data received for Q1 and Q2

| Countries | Q1: Primary schools (Age 6 – 10): At the level of primary schools there is no specific sports training included in the teaching time; according to the curriculum, children attend 10 – 12 weekly hours of “general sport education” within the 4 years of primary school; at this stage it is up to the parents to sign up for additional sport activities at one of the many sport federations in the spare time of the pupil. Q2: No data received regarding their number; all are funded by the state (public funding). Q1: Lower Secondary school (Age 10 – 14): For this age group there are two types of schools, which follow basically the same curriculum, that support in a specific way, the physical and sport development of pupils; these types of schools offer up to 29 weekly hours of “general sport education” within these 4 years; at this level, schools start to cooperate with sport clubs for specific training sessions that take part within the “general sport education”. Q2: 183 schools; all are funded by the state (public funding). Q1: Upper Secondary schools (Age 14-18): For this age group there are specific sport schools, that can only be attended by pupils that already proved a high performance level in a specific sport discipline and pass a qualifying exam; as sport and training plays a tremendous part in these type of schools, in order to unite training and reach the learning goals of upper secondary school, the schooling period may be extended for an additional year (instead of 4 years of upper secondary school, pupils may attend school for 5 years). Therefore, this pathway it is called “Dual Career” (School and Sport). Q2: 28 schools; most of them are funded by the state (public funding) and few are privately owned (which mean that the teachers are paid by the state). Concerning the specific funding of the sport schools at upper secondary level there is a strong cooperation between the ministry of “education, science and research” and the
Czech Republic

Q1: Basic schools aimed at sport (ISCED 1 and 2) do not differ from other basic schools, means they have to fulfil the Framework Educational Program for Basic Education set at the central level; on the other hand, they may have a school educational program with the focus on sport, e.g. more disposable hours devoted to physical education; those schools usually organize various sports-related courses in addition to schooling; some schools cooperate with a sports club and adapt the schedule of lessons to the club’s training time.

Q1: Upper secondary vocational schools as basic schools can focus on sports in their school education programs (e.g. upper secondary school of sports management, upper secondary school of economics with sports focus); it is supposed, that these kind of schools are more attended by active athletes; schools have to respect the same educational programs framework as other schools, but focusing for example on economics or management; educational program framework is set only for a few branches related to sport – e.g. management of sport facilities, masseur of athletes.

Specific framework education program aimed at sport is for Sports training secondary general school ("gymnázia se sportovní přípravou"), ISCED 2 and ISCED 3 or only ISCED 3; educational content and time allocation are different from the other secondary general schools (in total, 64 teaching hours are devoted to physical education and sports training, which means that the total compulsory number of teaching hours during studies is 184 and concurrently the number of lessons per week in one grade is 46); they can only be attended by pupils that pass an aptitude test (according to the Education Act, the result in the common admission examination represents at least 60 % of the overall assessment of fulfilment of the admission procedure criteria whereas in case of Sports training secondary general schools it is 40 %).

Q1: School sports clubs ("školní sportovní družina" and "školní sportovní kluby") operated by some schools as one of the forms of school facilities for personal interests education (developed to provide appropriate educational, training or recreational services and events, as well as cultural activities for pupils, students, and education staff or other persons).

Q2: No data received regarding their number; they are supported financially from the state budget (public funding), but parents pay some fees (the amount of the payment may not exceed 150 % of the average actual non-investment expenses per participant in the previous calendar year) and the local authorities as the statutory authority also often financially contribute to schools sports clubs.

Finland

Q1: In compulsory primary and lower secondary education there are schools that have a sports orientation (means that they have some extra lessons in sports and physical education); they are municipal and receive their funding as any other school.

Q2: No data received regarding their number; the local authorities pay about 58 % of the cost of basic education; in addition to providing about 42 % of statutory funding, the government grants discretionary subsidies to education and its development and, in basic education, funding for construction.

Q1: At upper secondary level there are sports-oriented schools, whose curriculum is flexible to allow for more sports and physical education; generally, those who attend these schools are involved in competitive sports.

Q2: 12 schools; the local authorities pay about 58 % of the cost of general upper-secondary education; in addition to providing about 42 % of statutory funding, the government grants discretionary subsidies to education and its development and, in general upper-secondary education, funding for construction.

France

Q1: The Sports and Physical Education ("Éducation Physique et Sportive" - EPS) which is the “normal” sports class throughout compulsory education (general, technological or vocational education alike); EPS initiates students to the enjoyment of physical activities, but in the same time giving them access to a wide range of practices with cultural and social implications that are important in the development of the personal and social life of each individual; it brings the student to consider well his/her own health, as well as helping him to develop into a perceptive and autonomous citizen.

Q2: EPS, is part of compulsory education and funded as such.

Q1: The school sport sections ("sections sportives scolaires") offers secondary education students that are willing (after discussion with the family) to take the opportunity of a more sustained training in a sport discipline available at the school, while following a normal, compulsory education; these sections are regulated by the circular letter no. 2011-099 of
September 29th, 2011; they are opened in a secondary education institution by a decision of the Recteur d’Académie, after a demand by the School head. Each section is to be opened within the frame of a long-term formalized partnership with a sport federation; a new section has to be opening for at least for at least 3 or 4 years, representing the length of schooling of the student in the institution (4 years in collège, 3 years in lycée). The allocated time for the student has to be integrated in his/her normal schedule, and cannot replace in any way his/her instruction time of EPS.

Q2: more than 3,000 school sport sections; additional resources of the school may be allocated to the section, as long as the project is compliant with national requirements.

Q1: A third option exists for secondary education students that have a sport practice of excellence and / or aim at becoming a professional athlete (concerned athletes have to be recognized by the Ministry of Sports); such practice falls under the regulation of the circular letter no. 2014-071 of April 30th, 2014, and allows the students in secondary education (11-18 year old) to adapt his/her schedule, but also allows him to go into schools that he/she wouldn’t normally apply to because of the school sector, to have a priority access to a boarding school, or even to adapt his/her exam schedule.

Q1: Physical education is viewed more than a school subject; it includes the often-large extra-curricular offer of sports activities that have gained significance in the context of the extension of all-day offers at schools. Therefore, the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (Kultusministerkonferenz) cooperates with the institutions providing extra-curricular offers at school, as for example the German School Sports Foundation (Deutsche Schulsportstiftung) or the German Olympic Sports Confederation (Deutscher Olympischer Sportbund – DOSB).

In the Länder, the responsibility for Physical education at schools lies with the ministries of education. Sports in clubs and associations is being coordinated in the Conference of the ministers of sports of the Länder.

Q1: Sports training for children and pupils aged 5-19 takes place during gym classes and is organized both in schools (according to the athletic/sports facilities available) and outside schools (i.e., swim classes for pupils of the third and fourth class of primary education). School sports centers situated inside school grounds as such do not exist. The national strategy for sports development supervised by the Hellenic Ministry of Education involves yearly national sports competitions for general upper secondary and vocational schools (for both team and individual sports); these competitions address pupils with exceptional performance in relevant sports; first, second and third winners of both individual and team sports are offered the initiative of acquiring extra credits needed for entering HEIs. Outperforming students in the Panhellenic school races for individual and team sports may participate in worldwide school races with further accreditation. In addition, each school year the Hellenic Ministry of Education administers innovative athletic activities in the two national sports centers of Athens in Kessariani which are under its supervision; pupils from all schools (regardless of their level) could participate in these activities.

Q2: The costs of the above sports and athletic training is covered by the state budget and is managed by the Directorate of Physical Education with the Hellenic Ministry of Education.

Q1: According to the 2010 reform of the general pathways (“licei”), starting from school year 2014/2015, at upper secondary level, sport sections are structurally integrated in some “licei scientifici” (in such a situation, the school organization became scientific high school which address sports issues - “liceo scientifico ad indirizzo sportivo”). The sections of the sports scientific high schools are aimed at the in-depth study of physical sciences and one or more sports disciplines within the general cultural framework of the traditional scientific high school. Their organization is regulated by the Decree of the President of the Republic n.52/2013.

Q2: 248 schools, out of which 174 are public schools and 74 are publicly subsidized schools.

Q1: In Norway, sports is the responsibility of the Ministry of Culture. In Upper Secondary Education (age 15-19) pupils that are enrolled in the Education program area for Sports, in addition to the core subjects, may choose among specialized program subjects like: Broad-level sports, Outdoor life activities, Physical training leadership, Leadership development, Sports and society, Physical training skills, Physical activity skills, Top-level sports.

Q1: There are four basic forms of organization of sports training in primary and secondary level schools: (1) Sports sections/ classes or (2) sports masterclass sections/ classes (these classes can be established in any school); (3) Sports schools and (4) sports masterclass schools.

A sport section/ sports masterclass section is one that runs for at least 3 years, offers
training in one or several sports and gathers 20 students in case of a sports section (in case of a sports masterclass section the number of students is not limited, but the idea is to group individuals with similar – excellent - sporting achievements).

A sports school is one which delivers a program of a primary, lower secondary or upper secondary school and combines it with sports training in one or several sport disciplines, in at least two of its sections/ classes (i.e. group of students), which consist of minimum 15 pupils per section/ class, for at least three consecutive grades of a given type of school. The compulsory weekly sports schedule consists of at least 10 hours.

A sports masterclass school is a school where compulsory weekly schedule of sports classes consists of at least 16 hours and is implemented along with general primary, lower secondary or upper secondary school program. The sports training in at least one section/ class of the school embraces one or several sports disciplines for three consecutive grades of a given level of school. The number of pupils is not regulated as it depends on the possibility of assembling individuals with a similar sporting level.

Q1: Focusing on Sports Education, there are two paths within the Spanish Education System which deal with specific sports training: (1) specialized sports education, that includes Intermediate Training Cycle: ISCED 3 (16-18 year old) and Advanced Training Cycle: ISCED 5 (+18 year old); (2) vocational training, that includes Intermediate Vocational Training related to Sports: ISCED 3 (16-18 year old) and Advanced Vocational Training related to Sports: ISCED 5 (+18 year old).

Specialised Education is developed in “specific centres for sports education” and other education institutions, and Vocational Training is developed in Secondary Schools.

Q2: 187 Intermediate Vocational Training organizations (out of which 119 are public centres, 23 are publicly-funded private centres and 45 are non-publicly-funded private centres); 299 Advanced Vocational Training organizations (out of which 168 are public centres, 20 are publicly-funded private centres and 111 are non-publicly-funded private centres); 96 Specific Centers for Sports Training organizations, for both intermediate and/or advanced training cycles (out of which 7 are public centres and 89 are private centres); 153 Intermediate Training Cycles organizations (out of which 54 are public centres and 99 are private centres); 49 Advanced Training Cycles organizations (out of which 19 are public centres and 30 are private centres).

Q1: Within the autonomy that all schools have, some schools may choose to place a particular focus on physical education and sports. In some cases, these are schools that were formerly designated as specialist schools, which included Sports Schools. This was a UK government initiative that encouraged secondary schools in England to specialize in certain areas of the curriculum to boost achievement and these schools could access ring-fenced government funding. However, since 2010, the specialist schools’ program is no longer active.

In England, under the reformed national curriculum, physical education is a compulsory subject at all key stages. Academies and free schools do not have to follow the National Curriculum but are required to provide a broad and balanced curriculum that promotes, among other things, the physical development of pupils. Schools can extend the length of their school day to provide extra-curricular activities, which may include sports clubs.

Q1: There are a range of organizations involved in delivering sport in Scotland, including local authorities and their leisure trusts, Scottish governing bodies of sport (SGBs), other representative bodies, sports clubs, higher and further education institutions (colleges and universities) and third sector organizations. However, at pre-university level, there are no schools with specialized sports program.

Source: Authors own development, based on responses received through the Eurydice national units from 12 states

As could be seen, in none of the above 12 European states they are not similar school organizations with the Romanian schools sport clubs, that are in the same time schools and sports structures, registered both in the school networks at the local (county) administrative level, but also in the sports registers administered by the line ministries.
Conclusions and further developments

Despite a rising trend in providing physical education for all, the principle of subsidiarity that allows Member States to keep their authority in certain areas, including education, determines differentiated approaches in terms of schools with sports program dedicated to performance. In none of the 12 states whose information was analysed and processed there are no school organizations similar to school sports clubs, dedicated to performance sports and registered as sporting structures. Therefore, in order to identify management factors favourable to sport performance we will have to limit our efforts only at the national level and deepened our research in another direction, respectively in the directions of double subordination and double membership to see if they represent an obstacle or an advantage for these organizations and for sport performance, in general. Much more, the Church Model of Sport who captures properly our national specificities and organizational roles on the path of sports performance has no applicability in any of the educational systems analysed.

The limits of this research are given by the fact that it refers only to the educational systems in thirteen European states – Austria, Czech Republic, Finland, France, Germany, Greece, Italy, Norway, Poland, Romania, Spain, United Kingdom – England, Wales and Northern Ireland and United Kingdom – Scotland.

Authors’ contributions

All authors contributed equally to this article.

References

HOW CAN ATHLETES BECOME SOCIAL ENTREPRENEURS?

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Abstract. In April 2011, the concept of social enterprise was included at European level as an engine for increasing the competitiveness of the European Union in the “Single Market Act”. Recently, social enterprises have become topical in the new “Social Business Initiative” and “European Social Entrepreneurship Funds”. Unlike traditional entrepreneurship, social entrepreneurs seek primarily to generate social value rather than profits, their work pursuing long-term poverty mitigation. This does not exclude the desire to make profit, but profit is often reinvested or shared among members, or it helps the community in one way or another. In a great phenomenon as sport, in this huge industry involving in particular young people, the former athletes, student-athletes or employee-athletes could create professional sectors. For many other people who aspire to a future in this area, they can transform the society from an educational, cultural and even economical viewpoint. Also, they can organize dual career support services, provide structural measures and enhance the competences of athletes in the light of developing their careers. This paper shows how former athletes, student-athletes or employee-athletes are driven by a great desire to find innovative ways to solve social problems, trying to transfer ideas from sports to the market or public sector to improve the social environment. Athlete entrepreneurs can implement a healthy and active lifestyle because they have bright ideas and are willing to create and disseminate new educational approaches, new methodologies and techniques. Also, they are continuously searching for sustainable solutions able to generate social value.

Keywords: sports, enterprises, economy, social problems.

Introduction

Social entrepreneurship is a form of entrepreneurship in which a “social enterprise” is established to solve social problems, placing the reinvestment of profit on the forefront.

The essence of social entrepreneurship is to pursue the improvement of living conditions and provide opportunities for disadvantaged or vulnerable people.

Social entrepreneurship is an initiative of an entrepreneur and must not be confused with the corporate social responsibility, which is about managing a business. Companies that are socially responsible take into account the interests of several groups, such as employees, suppliers, partners, the local community or the nation. The goal is the positive image, notoriety, trust, lasting relationships with all the factors that the company comes into contact with. The two concepts have many elements in common, but the major difference comes from the decision level.

Unlike traditional entrepreneurship, social entrepreneurs seek primarily to generate “social value” rather than profits, their work pursuing long-term poverty alleviation. This does not exclude the desire to make profit, but it is often reinvested or shared among members, or it helps the community in one way or another.

In Europe, there is a new perspective on social entrepreneurship and there is a political document that tackles the issues related to social, cultural and environmental values. In 2014, the Strasbourg Declaration was signed on 16 and 17 January, when over 2000 social entrepreneurs and supporters of social enterprises came together to debate the role of social entrepreneurship in the future (and present) of Europe. Commissioner László Andor said “After the 2011 Social Business Initiative a real European community of social entrepreneurs emerged, as shown by the unique and inspiring meeting in Strasbourg. I hope the community will keep growing, also with support of EU funds, and that social entrepreneurs will support each other and spread know-how across countries, so that we achieve inclusive growth in line with the Europe 2020 vision”.

“Social enterprises offer a model for 21st century business that balances financial, social, cultural and environmental needs. Social entrepreneurs are agents of change, as individuals and groups who are passionate about improving the lives of people and communities. Social enterprises work. They are effective. There is no part of Europe that cannot benefit from social entrepreneurship. At this time of economic crisis and with the challenges of an ageing population, youth unemployment, climate change and increasing inequalities, Europe needs more social enterprises” (“Strasbourg Declaration”, 2014).

According to Bessant and Tidd (2011, pp. 61-62), the process of social entrepreneurship is placing an emphasis on the purpose of social responsibility, possession of vision, opportunity identification (which can be both conscious and unconscious), search for the necessary support in implementing changes, and the role of risk.
management. Gauca and Hadad (2013) analyse the social entrepreneurship in relation with social innovation, social businesses and their connection to a very much debated topic – the civil society.

Based on Perrini, Vurra and Costanza (2010) a conceptual model was created as explanation for social initiatives. The model refers to the following:

1) the opportunity is determined; that reflects the entrepreneurs’ perception of the existence of inappropriate social situation;
2) evaluation - focusing on the balance between projects’ sustainability and social impact;
3) mission - principles and innovation of the initiative are parts of the opportunity;
4) social responsibility - mission and principles are transferred to a similar context;
5) an opportunity occurs due to the underlying potential of social entrepreneurship model and makes it possible to expand in a different context and provide a wider coverage of social impact.

In this paper we aim to highlight the way in which athletes and former athletes’ value all the brand and personal traits created in the field of sport, in order to contribute to finding solutions of the social issues.

**Topic addressed**

**Athletes’ entrepreneurship traits**

In a great phenomenon as sport, in this huge industry where especially young people are drawn in, former athletes, student-athletes or employee-athletes can create professional sectors. For many other people who aspire to a future in this sphere, they can transform the society from a cultural, educational, and economical point of view. They can organize dual career support service, provide structural measures, and enhance the competences of athletes for the development of their careers.

An interesting approach is offered by Driessens (2013) who emphasizes the potential celebrity capital of some athletes, and the entrepreneur role they can play in social and economic fields during their active and post-retirement years (Driessens, 2013; Ratten 2015).

Former athletes, student-athletes or employee-athletes can provide expertise, frameworks, instruments, and guidelines for the education regarding a dual career and certifications. It’s easy for them to combine their athletic career with their educational and work pathways.

Athlete entrepreneurs are individuals with innovative solutions to most pressing problems of society. Dual career athletes, from a developmental perspective, are professional consultants in an educational or sport organization. They act to change society through sports activities, together with their friends or with elite athletes having social involvement. Athlete entrepreneurs are seizing opportunities which others miss in order to improve the domain of sport.

An interesting approach is offered by Wilson, Van Luijik and Boit (2015) who introduced the concept of “social movement entrepreneurs” to describe the role of high-profile athletes in sport-related reconciliation efforts.

Athlete entrepreneurs are driven by a great desire to find innovative ways to solve social problems, trying to transfer ideas from the sports domain to the market or to the public sector, in order to improve social life. They have bright ideas and are gifted to create and disseminate new educational approaches, new methodologies and techniques. Therefore, athlete entrepreneurs can implement a healthy, kinetic lifestyle. Also, they are constantly searching for sustainable solutions that can create social value.

For athlete entrepreneurs the social meaning is to recognize a problem and use the entrepreneurial principles to organize some activities, from a specific domain (sport) that can sustain the solution for social change.

An athlete or a former athlete is an open-minded and sociable person, often a leader who used to travel a lot, be part of a team since early childhood, and, consequently, can become integrated more easily in a community or a social group.

Various organizations warned about the education quality, urging the involvement of young athletes in vocational education, to find dual career pathways for those involved in sports. Thus, EU funded studies and elaborated guidelines for good practices. Guidelines have been developed in reference to:

- appropriate methods and instruments to safeguard the balance between sport and education;
- diverse competences to improve sport and social life;
- various opportunities for implementing dual careers in the vocational education and training sectors;
- pursuing academic education and sports career - for former athletes.

On one hand, former athletes, student-athletes or employee-athletes can easily associate their sporting career with education or work. On the other hand, sportspeople often choose between education and sport or work.
athlete entrepreneurs can guide and sustain them to attain a new career, after their sporting careers - as part of a lifelong career, to protect the position of athletes and to support them to develop dual careers. Their guidance could be very helpful. It could improve the living conditions, but it should respect the diversity of competences and traditions.

A successful dual career offers a proper lifestyle balance between sports training and employment. Also, talented and elite sportspeople can end their sport career and have a good follow-up after their active sport careers. To build a dual career it is important to have a special program in which the athletes' individual needs would meet their age, competitive sport profile, financial status, and their social life in general.

**Elite athletes as social entrepreneurs**

The elite athletes have an important social role in their communities, so they may act as role models. It is important for the athletes to be trained for dual careers or to have social initiatives, bringing their contribution for the social development and economic growth.

Here there are few examples of former athletes who became social entrepreneurs and launched successful social enterprises that aim to make a difference, and help the world become a better place (“29 Pro Athletes Who Became Entrepreneurs, and How They Are Still Winning out of the Stadium”):

Spanish soccer player Juan Mata has partnered with football charity organization Street Football World to launch his charitable movement, Common Goal. Footballers who signed up for this cause pledge 1% of their salaries to a central fund that is allocated to high-impact organizations that harness the power of football to advance the United Nations’ Global Goals.

Indian American professional tennis player and Princeton graduate, Shikha Oberoi, launched her media and lifestyle company - SDU Seva Inc., in 2013. Using the huge potential of sports and television, she made six documentaries to encourage people becoming more involved in social reform within India, and created a reality show that is used as a platform for social entrepreneurs.

The sport history presents a lot of athletes that after their retirement started to work as entrepreneurs. We will present some of their stories in order to emphasize the huge potential of economic impact of their personal brands.

Alex Rodriguez, is a famous former baseball player, with a sport career that lasted over 20 years; he created a real estate business and later on he developed his business in industry, sport, wellness, media and entertainment. He is a mentor for young athletes that face economic challenges and takes part in some charitable events. He is a member of the University of Miami, Florida University Board and he financed over thirty students that faced economic problems.

Nastia Liukin, a multiple Olympic gold medallist, is another example. After her retirement, Nastia created an app (Grander) used for mentoring female athletes in the beginning of their careers. She initiated a gymnastics competition and gave different inspirational speeches for young athletes.

Shannon Miller is a famous gymnast, Olympic champion in Barcelona (1992) and in Atlanta (1996). She managed to assign ambition and strength from her sport career to the everyday life through Shannon Miller Campaign Lifestyle: Health and Fitness for Women (2010). As a cancer survivor, Shannon kept fighting harder for women’s healthy lifestyle, for the prevention, early diagnosis and modern treatment of this disease.

**Conclusions**

This research examines the cultural influences and explains how different types of social, emotional and leadership capital from sports area are suited to promote social entrepreneurship.

Athletes have certain personality traits that help them to adapt to competitive socio-economic environments after their retirement. Using their image as former athletes, their brand, they enjoy successful sport activities (as coaches, sports journalists, managers), and in connected areas (social, economic) while keeping their sport perspective.

Their personal traits, their personal brand created during their sport career offer the right premises for a successful social project, charity and educational campaigns. The former athletes offer academic and sport scholarships for the youngsters who look for a sport career.

Entrepreneurship is an important option for a post-active life of the elite athletes; a complex path with social, cultural and economic outcomes. Entrepreneurship implies a careful future analysis according to the region or country where it belongs.
Acknowledgement

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References


ASPECTS REGARDING THE ASSESSMENT AND MAINTENANCE OF BODY MASS INDEX IN ADULTS

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Abstract. Body Mass Index is a scientifically recognized indicator established following the results of large-scale population studies focused on revealing the connection between the height-weight ratio, on the one hand, and the health status, on the other hand. Statistics show that people whose Body Mass Index is between 18.50 and 25 have a better state of health. Going beyond this range, in both the positive sense and the negative sense (excessive weight deficit), represents a risk for the individual’s health status. In this paper, we aimed to highlight aspects regarding the assessment and maintenance of Body Mass Index in adults. In this regard, we established as tasks the assessment of weight and height, as well as the calculation of Body Mass Index in order to detect the incidence of adults with weight imbalances in relation to age. The regular involvement in a prophylaxis programme was intended to induce a decrease in body weight in adults with imbalances from this point of view.

Keywords: assessment, Body Mass Index, adults.

Introduction

Since ancient times, Hippocrates stated that the systematic practice of physical exercise would be one of the best remedies for maintaining and enhancing the state of health.

The use of physical exercise, as an accessible and efficient means of maintaining and enhancing the health status by increasing the body’s resistance to disease and treatment in various unfavourable biological situations, is recommended in all stages of human development (Mârza, 2005, p. 9).

The state of health can influence body weight in a beneficial way (or not), and conversely, any decrease or increase in body weight can influence, for better or worse, the health status. For this reason, maintaining normal body weight is one of the most important ways of maintaining the state of health and preventing the risk of disease (Raymond, 2007, p. 25).

Body composition is the aggregate of the composite parts of the human body and is expressed by body weight. The proportion of these components and their distribution represents the body structure, which is expressed in absolute, relative or percentage values. These values express not only the physical characteristics of the body, but implicitly they also provide information on body functions. The human body is a complex dynamic system consisting of subsystems with very different structure, chemical composition and density (proteins, water, fats, etc.) maintained in constant proportions and functionally integrated. Any disturbance in their distribution will cause functional imbalances that increase the risk of disease or generate specific pathologies – obesity, malnutrition, oedema, dehydration, increased blood pressure (Crețu, 2009, p. 335).

Body composition, approached as a cybernetic system, is an organic structure described on 5 levels of subsystems, whose complexity increases progressively. Atomic subsystem – refers to the aggregate mass of 50 chemical elements that are indispensable to life; total body mass is determined, in a 98% percentage, by combinations of oxygen, carbon, hydrogen, nitrogen and phosphorus, the other 44 elements representing less than 2% of body mass. Molecular subsystem – is based on at least 100,000 chemical compounds systematised into lipids, proteins, water, carbohydrates and minerals. Cell subsystem – includes total cell mass, extracellular fluid (interstitial fluid, lymph), extracellular solids (collagen, elastic fibers) and inorganic substances (calcium, bone phosphorus). The subsystem consisting of tissues, organs and anatomic-functional systems – bone, adipose and muscle tissues represent 75% of body weight. The subsystem of the body as a whole is characterised by height, body mass and volume (Cordun, 2009, pp. 99-100).

Determining body composition is a fundamental measure of the health status, which helps to properly assess the nutritional status and monitor the treatment of nutritional imbalances.

In this research, we aimed at assessing the subjects in order to determine both the stage at which they were in terms of age-related weight and height and the effectiveness of physical exercises/means of rehabilitation through physical therapy, with applicability to overweight adults. Thus, the following research tasks are noted:

- calculating the Body Mass Index in order to detect adults with weight imbalances in relation to age;
- applying specific intervention measures (a physical exercise programme that, if performed on a regular basis, can lead to a decrease in body weight in adults with weight imbalances in relation to age);
- checking the efficiency of the means of rehabilitation through physical therapy (with applicability to overweight adults).

**Material and methods**

**Participants**

The ameliorative study involved 44 participants, of whom 13 subjects aged 20 to 30 years, 19 subjects aged 31 to 40 years and 12 subjects aged 41 to 50 years.

**Procedure**

The research took place between January and June 2018 at the “Know Limits” fitness room in Bacău, where we carried out the investigations, tests and practical application of the adult-specific exercise programmes. The fitness room was equipped with all the materials needed to conduct the research.

In order to assess the recommended weight, we used the Body Mass Index (Balint, 2006, p. 65; Vișan, 2019), which represents the ratio of body weight expressed in kilograms to body height expressed in centimetres squared. This index establishes the correlation between subcutaneous adipose tissue and total body fat, being the most useful indicator in obesity screening. If the value obtained by measuring the Body Mass Index ranges from 19 to 24, it is considered to be the ideal weight. A value ranging from 25 to 30 indicates overweight, and over 30, obesity.

In this research, with the help of Body Analysis scales, we obtained the following data: body fat percentage, muscle mass percentage, visceral fat percentage and metabolic rate. The OMRON device uses electrical impedance, together with information on the subject’s height, weight, age and gender, in order to generate the intended results. The indices obtained with the Body Analyser are relevant when measurements are performed in the morning after waking up, before breakfast, or more than 2 hours after meal.

Body fat percentage is the ratio of adipose tissue to total bodyweight and is calculated according to the formula: Body fat percentage (%) = \{Body fat mass (kg) / Body weight (kg)\} × 100. A body fat percentage ranging from 17% to 26% is considered as normal for men, and for women, from 22% to 33% (Lindberg, 2019).

Muscle mass percentage represents 38% to 54% of body weight in men and 28% to 39% in women, depending on their physical fitness and age. Visceral fat with values between 1 and 12 are considered to be normal, and values between 13 and 59 are correlated with excess visceral fat and a predisposition to metabolic disorders (Frothingham, 2018). Metabolic rate is the energy intake that the body needs in total resting state to maintain its vital functions.

The physical exercise programmes lasted 50 minutes and were performed two times a week. They included an initial part consisting of warm-up exercises, a fundamental part comprising dynamic games and specific exercises and a final part based on stretching and breathing exercises (Balint, 2006, p. 117). The role of these programmes was to educate and motivate the research subjects to adopt a healthy lifestyle including physical activity (performed on a regular basis) in order to maintain optimal body weight in relation to age.

**Objectives of physical exercises:**

- Preventing the adoption of poor body posture and maintaining correct body posture;
- Forming and maintaining the reflex of correct body posture;
- Reducing and maintaining body weight within normal limits and preventing the onset of obesity;
- Adaptation of breathing to the walking pace;
- Awareness and adoption of correct posture during exercise.

**Methodical indications:**

- exercises were correctly performed, with 10-second breaks between repetitions, under careful supervision;
- each exercise in the fundamental part is performed for 50 seconds;
- a series consisting of exercises from the fundamental part is followed by a 1-minute break – 5 series are performed.

Tables 1 and 2 show the intervention programmes applied to adults.
Table 1. *Personal contributions to the development of intervention programmes for adults*

<table>
<thead>
<tr>
<th>Initial part – Warm-up exercises/ Preparing the body for effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>in the standing position with hands on hips, perform flexion of the head on inhalation and extension of the head on exhalation (2 x 4 repetitions)</td>
</tr>
<tr>
<td>in the standing position with legs apart and arms stretched forward, perform arm scissors (1 x 15 repetitions)</td>
</tr>
<tr>
<td>with arms stretched sideways, perform flexion and extension of the forearms (1 x 15 repetitions)</td>
</tr>
<tr>
<td>with arms bent at 90 degrees and forearms up, perform flexion and extension of the forearms (1 x 15 repetitions)</td>
</tr>
<tr>
<td>with arms stretched up, perform alternate flexion and extension of the arms (1 x 15 repetitions)</td>
</tr>
<tr>
<td>perform concomitant forward and backward circumduction of the arms (2 x 15 repetitions)</td>
</tr>
<tr>
<td>with hands on hips, perform trunk rotation to the right and left by inhaling at the movement initiation and return on exhalation (2 x 15 repetitions)</td>
</tr>
<tr>
<td>in the standing position with half-bent knees close together, perform right and left circumduction movements (2 x 15 repetitions)</td>
</tr>
<tr>
<td>light run on the spot by gradually increasing the pace for 20 seconds, and then fast run on the spot for 45 seconds</td>
</tr>
<tr>
<td>squats: in the standing position with legs apart at shoulder width, slightly lean the trunk forward by lowering it to the sitting position on inhalation and return on exhalation</td>
</tr>
<tr>
<td>the scale: in the prone position with forearm support and elbows on the shoulder line and apart at shoulder width on inhalation, with support on tips, raise the pelvis on exhalation so as to obtain a straight line between the vertex and heel – hold this position</td>
</tr>
<tr>
<td>alternate forward lunges: in the standing position with knees apart at hip width, chest forward, shoulders backwards, take a big step forward so as to reach a 90-degree angle between the calf and thigh when bending the knee; lower until the front thigh is parallel to the ground, the knee is on the ankle line; when lowering, the knee follows the direction of the tiptoe – inhalation and return on exhalation</td>
</tr>
<tr>
<td>the bicycle – in the supine position with palms behind the head, shoulder blades raised off the ground, lower limbs and knees bent so as to reach a 90-degree angle between the calf and thigh, calf and trunk, perform the alternate thigh-knee extension and return on exhalation</td>
</tr>
<tr>
<td>in the standing position, perform 4-stroke breathing exercises with arm abduction up to 90 degrees and 4-stroke return on exhalation (2 x 5 repetitions)</td>
</tr>
<tr>
<td>4-step tiptoe walking on inhalation, and then, with arms in abduction, 4-step walking on the whole foot on exhalation</td>
</tr>
<tr>
<td>walking with the forward circumduction of the arms, with deep inhalation and exhalation for 1 minute walking by adopting appropriate posture and normal breathing for 2 minutes</td>
</tr>
</tbody>
</table>

Table 2. *Exercises from the fundamental part*

<table>
<thead>
<tr>
<th>Fundamental part</th>
</tr>
</thead>
<tbody>
<tr>
<td>perform the scale by carrying the palm to the opposite shoulder: in the prone position with palm support, palms on the shoulder line and apart at shoulder width – inhalation, with support on tips, raise the pelvis on exhalation so as to obtain a straight line between the vertex and heel – hold this position and alternately carry the palm to the opposite shoulder</td>
</tr>
<tr>
<td>in the crouching position with palms on knees and straight back, perform the “dwarf walking” in the quadrupedal position, perform hip abduction and adduction with stretched or bent knee, alternately on both lower limbs</td>
</tr>
<tr>
<td>in the supine position with soles on the ground, raise and lower the pelvis vertically by inhaling at the movement initiation and return on exhalation</td>
</tr>
<tr>
<td>squats with heels off the ground: in the standing position with legs apart at shoulder width, slightly lean the trunk forward by lowering it to the sitting position on inhalation, return on exhalation and raise the heels off the ground;</td>
</tr>
<tr>
<td>in the supine position with bent knees and soles on the ground, perform the trunk flexion on the pelvis while raising the shoulder blades off the ground, with inhalation and exhalation at the end of movement</td>
</tr>
<tr>
<td>in the sitting position with forearm support, perform the alternate flexion and extension of the lower limbs by maintaining a 45-degree angle after each repetition cycle, in the side-lying position with forearm support, perform abduction of the opposite lower limb by inhaling on the adduction movement and exhaling on the abduction movement</td>
</tr>
</tbody>
</table>
Results

In Table 3, we analysed the differences between the initial and final results.

Table 3. Initial and final average scores of the indices assessed by age category

<table>
<thead>
<tr>
<th>Indices</th>
<th>Assessment</th>
<th>Age category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20-30 years</td>
</tr>
<tr>
<td>Weight</td>
<td>Initial</td>
<td>72.8</td>
</tr>
<tr>
<td></td>
<td>Final</td>
<td>65.8</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>Initial</td>
<td>26.2</td>
</tr>
<tr>
<td></td>
<td>Final</td>
<td>23.6</td>
</tr>
<tr>
<td>Fat</td>
<td>Initial</td>
<td>37.6</td>
</tr>
<tr>
<td></td>
<td>Final</td>
<td>32.8</td>
</tr>
<tr>
<td>Muscle mass</td>
<td>Initial</td>
<td>26.4</td>
</tr>
<tr>
<td></td>
<td>Final</td>
<td>28.4</td>
</tr>
<tr>
<td>Metabolic rate</td>
<td>Initial</td>
<td>1498</td>
</tr>
<tr>
<td></td>
<td>Final</td>
<td>1426</td>
</tr>
<tr>
<td>Visceral fat</td>
<td>Initial</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>Final</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Figure 1. Graphical representation of the monitored indices and average scores by age category

Table 3 and Figure 1 highlight the average scores obtained in the initial and final testing of the above indices, by age category, as follows:
- In the age group 20 to 30 years, the average initial weight was 72.8 kg, and the final average was 65.8 kg, with a difference of 7 kg; in the age group 31 to 40 years, the average initial weight was 86.8 kg, and the final average was 78.7 kg, with a difference of 8.1 kg; in the age group 41 to 50 years, the average initial weight was 94 kg, and the final average was 84.7 kg, with a difference of 9.3 kg. It is noted, in both the initial and final assessments, an increase in the average body weight in relation to age;
- regarding Body Mass Index, the same increase in the average score is noted in relation to age. In the age group 20 to 30 years, the average initial score of Body Mass Index was 26.2, and the final average was 23.6; in the age group 31 to 40 years, the average initial score of Body Mass Index was 30.06, and the final average was 27.1; in the age group 41 to 50 years, the average initial score of Body Mass Index was 33.2, and the final average was 30;
- the percentage values for body fat were the following: in the age group 20 to 30 years – 37.6% (initially) and 32.8% (finally); in the age group 31 to 40 years – 38.1% (initially) and 32.9% (finally); in the age group 41 to 50...
years, a percentage of 44.09% was initially recorded, and finally, 39%, indicating a decrease in the obtained values, namely the body fat percentage, as a result of performing the controlled physical activity;

- the percentage values for muscle mass were the following: in the age group 20 to 30 years – 26.4% (initially) and 28.4% (finally); in the age group 31 to 40 years – 27.6% (initially) and 30.2% (finally); in the age group 41 to 50 years, a percentage of 24.6% was initially recorded, and finally, 26.8%, indicating a decrease in the obtained values, namely the muscle mass percentage;

- in terms of metabolic rate, the same increase in the average value is noted in relation to the age group (specifically, aging). In the age group 20 to 30 years, the average initial value was 1498, and the final average was 1426; in the age group 31 to 40 years, the average initial value was 1677, and the final average was 1597; in the age group 41 to 50 years, the average initial value was 1711, and the final average was 1598;

- regarding visceral fat, in the age group 31 to 40 years, the average initial value was 6.8, and the final average was 5.2; in the age group 31 to 40 years, the average initial value was 8.8, and the final average was 7.4; in the age group 41 to 50 years, the average initial value was 10.5, and the final average was 8.7. We highlight a decrease in the average value of visceral fat.

Conclusions

Based on the obtained results, we have drawn the following conclusions:

- the value curve for the monitored indices, namely Weight, Body Mass Index, Muscle mass, Metabolic rate and Visceral fat, is related to the age category (the values, except those for the muscle mass, increase with aging);

- by comparing the final results with the initial results, it can be noted that the controlled and monitored physical activity has positive effects on the overall health status (revealed by the values of the monitored indices);

- it is noted a decrease in the body fat percentage and an increase in the muscle mass percentage as a result of performing the controlled physical activity;

- a decrease in the average body fat is highlighted as a result of using the means of rehabilitation through physical therapy (with applicability to overweight adults).

Authors’ contributions

All authors contributed equally to this article.

References


STUDY ON IMPROVING THE SPECIFIC PHYSICAL TRAINING OF THE UPB REPRESENTATIVE FOOTBALL TEAM

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*Corresponding author: cretu_trans@yahoo.com

Abstract. The purpose of this study is to improve specific physical training. Resistance refers to the body's capacity to do a certain activity for a long time, speed is a feature of sprints, the explosive strength refers to the takeoff and the speed of acceleration refers to the starts on the spot. The research was carried out on the sports field of the UPB on a group of 22 students between the ages of 19 and 24, who were clinically healthy. The experiment took place between December 2018 and May 2019 and had two stages, the first stage was conducted on 10.12.2018 and consisted of passing specific tests, and the second stage was conducted on 10.05.2019 and consisted of passing the same specific tests after a period of six months. Throughout the training process between the two tests there were used methods for developing motor qualities. The tests used in the experiment refer to running on 50 m, running on 400 m, measuring the explosive force in the lower limbs (takeoff) and dribbling through the cones with the free-standing leg. The results obtained showed that there are significant differences between the values obtained at the final test compared to the initial test, which reflects the efficiency of the methods and means used for the development of the specific physical training.

Keywords: physical training, football, students.

Introduction

University football has become a sports game used in physical education lessons, as a means of improving physical training, but also a sports game that gathers more and more practitioners in national and international university sports competitions. The multitude of the actions and technical-tactical combinations of attack and defence that follow at a rapid pace requires a specific physical training that addresses all the segments of this preparation.

From the practical experience gained during the training lessons with the representative football team of the “Politehnica” University of Bucharest, we noticed the need to improve the level of technical training in accordance with the contemporary demands of the football game. The central objective of the specific physical training in football in non-specialty higher education is represented by the optimisation of the biomotor parameters.

Achieving superior performance in football involves many factors and depends largely on the use of modern methods in the training process (Ciocă, 2005, p. 60). To achieve top results in this sport, players need to have an exceptional level of technical and tactical qualities, as well as significant physical training (Svensson & Drust, 2005). Soccer is one of the most widely played and complex sports in the world, where players need technical, tactical and physical skills to succeed (Joksimovi et al., 2009). Explosive strength is a specific motor quality that is found in the football game. Numerous manuals but also other publications suggest the application of vertical jump tests to evaluate explosive muscle strength (Astrand & Rodahl, 1986). Explosive strength is usually defined as a capacity that allows reaching the maximum individual acceleration of one’s body, object or partner in throwing, jumping, hitting and sprinting activities (Milinkovic, Bašić, & Milanović, 2005, p. 14). Explosive strength is one of the determining factors of success in all sports and requires the use of muscle strength per unit of time (Newton & Kreamer, 1994).

The issue of takeoff development, both from the theoretical and practical viewpoints, represents an ongoing concern for many specialists in various fields (coaches, teachers, methodologists, physiologists, etc. (Pelin, 2007, p. 5). The strength of the human body is its ability to overcome internal or external resistance through muscle contraction, to resist an external force or to maintain a certain position (Tudor & Crișan, 2007, p. 41).

Grigoroiu et al. (2015), using the Myotest Pro software, obtained precise information and objective data that contributed to the improvement of the athlete training and the optimisation of the work strategy.

In this paper, we paid special attention to the improvement of the specific physical training in the football game, because we believe that the physical training plays a very important role in carrying out the technical-tactical actions both in the attack and defence phases.

The aim of the paper is to improve the specific physical training of the representative football team of the UPB by developing and implementing in the lesson some operational structures for increasing the biomotor parameters.
Our hypothesis is that the elaboration and implementation of operational systems for developing the biomotor parameters contribute to the improvement of performances (and physical training program) of the students in the football team.

**Material and methods**

The methods used in this research were: the direct and indirect observation method materialized by studying the planning documents and observing the students during the training hours, the experimental method, the evaluation method, the statistical-mathematical method and the graphic method.

**Participants**

The experimental research was carried out on a number of 22 students, aged between 19 and 24, from the “Politehnica” University of Bucharest, members of the UPB football team. The subjects who participated in the study were persons who have been practicing football for a minimum of 10 years, who were clinically healthy and did not have any injuries that could have worsened the health state after the experiment.

**Procedure**

The trials used during the initial and final testing consisted of: trial 1 – 50 m speed run; trial 2 – 400 m run; trial 3 – takeoff; trial 4 – leading the ball through the cones with the free-standing leg on a distance of 25 m and finishing with the free-standing leg from a distance of 25 m.

The evaluation in trials 1 and 2 consisted of timing the subjects over distances of 50 and 400 m, respectively. The evaluation at trial 3 (assessment of takeoff) was done by means of the Myotest device. Myotest calculates endurance, strength, speed and also endurance speed using a three-dimensional accelerometer. The sensor can detect the acceleration during the execution of the movement. The information obtained is transferred to a computer via a USB connection.

The evaluation at trial 4 refers to the number of goals scored after performing a series of 6 attempts. During the trial, the ball must not touch the cones, and the finishing in the goal must be executed in such a way that the ball does not touch the playing surface.

The students were informed about the training plans as well as the evaluation method. The research was carried out during six months, between December 2018 and May 2019, as follows: the first stage was conducted on 10.12.2018 and consisted of passing specific tests, and the second stage was conducted on 10.05.2019.

In Table 1, we present the intervention program that led to the improvement of the biometric parameters. In the programming and dosing of the means, the level of preparation of the students was taken into account.

**Table 1. Intervention program**

<table>
<thead>
<tr>
<th>No.</th>
<th>Biomotor Parameters</th>
<th>Exercises</th>
<th>Dosage Rep.</th>
<th>Time</th>
<th>Pause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>50 m Running</td>
<td>- ankle game with light movement for 30 s, with running start launched on 30 m;</td>
<td>5x</td>
<td>30''</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- side run on 20-30 m continued at the signal with speed run, but in a straight line on 50 m;</td>
<td>5x</td>
<td>30''</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- from the left squat with the back to the direction of running to the sound signal jumping with detachment and return to the direction of running, followed by the sprint on the distance of 30 m;</td>
<td>5x</td>
<td>30''</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- running behind, on 20 m, at signal, running on speed on 50 m;</td>
<td>5x</td>
<td>30''</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- with the back to the running direction, return followed by a sprint on the distance of 20 m;</td>
<td>5x</td>
<td>30''</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- speed run in 3/4 tempo over the 70 m distance;</td>
<td>3x</td>
<td>1.30''</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- speed run in tempo 4/4 on the distance of 70 m;</td>
<td>3x</td>
<td>1.30''</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- speed run in tempo 4/4 on the distance of 50 m;</td>
<td>3x</td>
<td>1.30''</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>400 m Running</td>
<td>- 400 m running distance;</td>
<td>4x</td>
<td>2.30''</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 200 m running distance;</td>
<td>6x</td>
<td>2'</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 250 m running distance;</td>
<td>6x</td>
<td>2'</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 300 m running distance;</td>
<td>4x</td>
<td>2.30''</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 500 m running distance;</td>
<td>4x</td>
<td>3'</td>
<td></td>
</tr>
</tbody>
</table>
### Results

The results obtained in the two tests, initial and final, are presented below.

<table>
<thead>
<tr>
<th></th>
<th>50M Running</th>
<th>Dribbling Among Cones</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Test</strong></td>
<td>6.5s</td>
<td>6.4s</td>
</tr>
<tr>
<td><strong>Final Test</strong></td>
<td>4.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

![Figure 1. Biomotor Parameters test 1 and 4](image)
Table 2. Statistical-Mathematical Indicators

<table>
<thead>
<tr>
<th>Test</th>
<th>Statistical-mathematical indicators</th>
<th>Progress IT-FT</th>
<th>dependent t test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 m Running</td>
<td>IT 6.52/0.18 FT 6.43/0.17</td>
<td>0.09</td>
<td>4.39</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>400 m Running</td>
<td>IT 59.4/0.98 FT 58.3/0.98</td>
<td>1.1</td>
<td>4.38</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Takeoff</td>
<td>IT 35.16/0.93 FT 38.66/0.95</td>
<td>3.5</td>
<td>4.21</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Dribbling among cones with the free-standing foot and finishing with the same foot</td>
<td>IT 2.5/0.51 FT 4.5/0.51</td>
<td>2</td>
<td>6.16</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

We find that in the 50 m trial, the value of the arithmetic mean at the initial test (IT) is of 6.52 seconds and at the final test (FT) of 6.43 seconds. The difference between the arithmetic means between IT-FT is of 0.09 seconds. The spreading degree of the string values represented by the standard deviation has the values at the initial test (IT) of 0.18, and at the final test (FT) it is 0.17. The value of the Student’s t-test calculated is 4.39, so 4.39 > 2.08 (at p < 0.05) as a result there are statistically significant differences between the means of the two tests.

For the 400 m running test, the value of the arithmetic mean at the initial test is of 59.4 seconds (IT) and of 58.3 seconds for the final test (FT). The difference of the arithmetic means between IT-FT is 1.1 seconds. The value of the Student’s t-test calculated between the IT-FT is 4.38. Because 4.38 > 2.08 (at the level of p < 0.05), there are statistically significant differences between the means of the two groups.

In the takeoff test, the value of the arithmetic mean at the initial test (IT) is 35.16 cm, and at the final test (FT) it is 38.66 cm. The difference of the arithmetic means between IT - FT is of 3.5 cm. The standard deviation has the values 0.93 (IT) and 0.95 (FT). The value of the Student’s t-test calculated between IT-FT is 4.21, therefore 4.21 > 2.08 (at p <0.05). As a result, there are statistically significant differences between the means of the two groups.

We notice that after performing the dribbling trial among the cones with the free-standing leg and finishing with a kick at the goal with the same leg, the value of the arithmetic mean at the initial test (IT) is 2.5 successful attempts, and in the final test (FT), it is 4.5 successful attempts. The difference of the arithmetic means between
IT-FT is 2 successful attempts. The value of the Student’s t-test calculated between the IT-FT is 6.16; whereas 6.16 > 2.08 (at p < 0.05), there are statistically significant differences between the means of the two groups.

Conclusions

The superior results obtained after the final tests prove that the training programs used positively influenced the physical training specific to the football game. The training programs applied to the students in the UPB football team contributed to highlighting significant differences between the two tests, which shows that the means that have been used in the training are effective.

The judicious elaboration of the operational means based on the development of the specific physical training in the football game, are operations that have led to the improvement of the participants’ performances, an aspect that confirms the research hypothesis.

The standardisation of the operational structures has led to increased efficiency of the methodological content intended to improve the specific physical training. We can say that the data recorded can complement the existing sources in the specialty literature, and the results obtained can help in preparing the university football teams.

Authors’ contributions

All authors contributed equally to this study and should be considered as main authors.

References

STUDY ON HEART RATE MONITORING IN FUNCTIONAL TRAINING

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Abstract. Functional training is a physical conditioning activity. It's not a new training method, but in the last 15 years it has enjoyed a strong promotion in fitness centers. One particularity of functional exercises is that they are based on the pattern of movements made by a person in daily activity. Exercises easily adapt to anyone regardless of age, gender, physical condition, from non-trained people to performance athletes. Physical effort is at the base of motric activity, seen from the outside, the effort is characterized by a series of indices such as volume, intensity, duration, complexity, etc. Physical exercise requires a complex response from the body: change of bioelectric activity at the muscle level, respiratory rate, heart rate, blood lactate level and other reactions. In this paper we used a heart rate monitor, Polar H10, that helped us to observe the body response to an effort in a training lesson that propose to improve the strength indices of the main muscle groups.

Keywords: functional training, heart rate, effort.

Introduction

Like other physical conditioning activity, functional training helps the practitioner to maintain or to improve the fitness level and implicitly health condition. The connection between health and physical condition has been emphasized since ancient times by the first holistic physician, Hippocrates, who supports the idea that diet and exercise are essential for good health (Berryman, 2003). The American College of Sport and Medicine recommends that each person should practice a minimum of 150 minutes of moderate-intensity physical activity weekly to achieve positive physical and mental effects (Paternostro, 2014).

Any type of physical activity must respect the principles of training and implicitly the target area of effort in order to produce expected physiological adaptations (Bota, 2006). The rules that guide this type of activity are the principles of sports training: the principle of progression, the principle of individualization (according to a number of aspects: age, profession, health status, fitness level and the list can continue), specificity and overload.

Originally designed for athletes, functional exercises aimed to help athletes to recover after an injury or as a means in prevention (Boyle, 2004). Bruce Lee, the famous martial arts instructor, used this type of exercises in his training, but at that time those did not have the name functional. The term functional training appeared since 1970 (Santana, 2016). The term "functional" is increasingly common in the fitness industry, equipment is described to be functional and instructors assign this term to the training they promote. Ultimately functional refers to an aspect that perform its purpose.

Training of this type provides the practitioner, an interesting and challenging alternative to improve the ability of the movement, the functionality of large systems, the development of conditional and coordinating capacities (Bota, 2006). One characteristic of the functional training is that the exercise system is based on the pattern of movements made by a person in everyday activity - locomotion, pushing and pulling, rotation, changing level. The previous division can also be applied in performance sports. For example: rotation - in daily activity changing direction of the movement, in gymnastics jumps and rotation 180 degrees; locomotion - in daily activity walking, in sport - running; changing the center of gravity - in daily activity taking an object from the ground, in sports - the basic position, handball (Boyle, 2004).

Compared to a bodybuilding exercise that works on the isolation of different muscle groups, and the movement is performed in a single plane, functional exercises simulate the natural movement of the body, involving a large number of segments requiring increased coordination. There is a fine line that differentiates a functional exercise form the other types of exercises, but a biomechanical analysis of the movement can edify (Cook & Fields, 1997). Exercises are easy to adapt to any practitioner regardless of age, sex, fitness level, etc., but to start any type of program of physical activities, the condition sine qua non is a medical exam. "At the base of any physical activity is the effort, a deliberately and precise request that mobilizes the whole body, both physically and mentally" (Dragnea, 1991, p. 50). To sustain the effort, the apparatuses and systems of the body amplify their activity, this demonstrates the reciprocity relation between body - effort. For an effective training, each coach needs to know these particularities. In functional training the effort is aerobic, effort that involves changes at the metabolic and cardio-respiratory level, the intensity is moderate to the height, practitioners usually have an
average of 3 hours per week. The effects of physical effort can be appreciated from the outside - volume, complexity, duration, etc., and from the inside - blood lactate level, VO2max, heart rate, etc (Bota, 2000).

Although functional training has gained significant popularity over the past 15 years, the number of practitioners increasing approximately 1000 times globally (Mangine et al., 2018), scientific study on heart rate monitoring is reduced. In this period there have been valuable studies on this topic, to be noted there are several aspects: the age of the subjects (participants are at middle age), the health state of the subjects and the physical condition - performance athletes.

In functional training, one of the easiest indicator for appreciate the effort is heart rate monitoring. This indicator can be monitored tactile, but the most efficient way is with a pulse tester. The first workout monitored with a wireless pulse tester device was in 1983. Monitoring of heart rate is useful for making training more efficient.

The age period in which the subject of the study is framed is the young adult age. An age at which the young people should be stimulated to have an active life and the socio-professional demands, mostly sedentary, do not affect their physical condition and implicitly their health status (Șchiopu & Verza, 1997).

Material and methods

Participants

At the research participated one female, 30 years old. Her physical fitness level was good - level of fitness was tested with Alpha Fit test battery. Alpha Fit is a fitness test battery for adults aged 18-69 years. This includes a number of four category of tests that evaluate: body composition, motor, musculoskeletal and cardiorespiratory fitness (Suni, Husu, & Rinne).

Apparatus

In our study we used: Polar H10 device, reformer, kettlebell, dumbbells and balance platform (bosu).

Polar H10 device consists of a belt and an attached device, it accurately measures heart rate and transfers data obtained via Bluetooth. We obtain data on effort areas, minimal, maximum heart rate, calories burned, etc.

Reformer - an apparatus formed of a rectangular frame on which the carriage slides, foot bar, the springs which connecting the machine frame with carriage. The movements made against spring resistance, body weight, create specific, eccentric contractions. The springs have different levels of resistance, if attached 2-4 springs indicate moderate-heavy weight recommended for strength development exercises, without springs attached - exercise to improve the balance, which implies increased neuromuscular control.

Bosu is a balance platform, an accessory used in recovery programs, enjoying success in fitness programs as well.

Kettlebell, dumbbell - accessories commonly used in training, can easily change any exercise by increasing the difficulty.

Procedure

In order to observe the body response the participant took part in a training lesson that propose to improve the strength of the main muscle groups.

Lesson duration: 50 minutes.

1. Initial position: Standing, the left foot on the fixed side of the reformer, the right foot on the carriage; Movement: Pushing the carriage with the left foot, the center of gravity will be half the distance between the lower limbs; return; Repeat on the other side; Dosage: 12 reps; tempo: slow;

2. Initial position: standing, kettlebell hold at the chest level; Movement: flexion of the lower limbs (plié); return to initial position; Dosage: 16 reps; tempo: moderate; weighting: kettlebell: 2 kg;

3. Initial position: standing, the kettlebell hold at the chest; Movement: lunge; continue to alternate the leg; Dosage: 16 reps; tempo: moderate; weighting: kettlebell: 2 kg;
4. Initial position: lie on carriage, legs stretched and raised at an angle of 45 degrees in the hip joint; soles in straps;
   Movement: Flex the legs; return to the original position;
   Dosage: 12 reps; tempo: slow; springs: 1 red; 1 blue;
5. Initial position: Lie on the carriage; legs bent, gambles parallel to the ground; grip the straps in the hands; arms forward;
   Movement: extend the legs to the vertical simultaneously lift the shoulders; return to the original position;
   Dosage: 8 reps; Tempo: slow; springs: 1 blue;
6. Initial position: Plank position; Hands grip the foot bar; Support peaks on the headrest;
   Movement: Push the bar to moves backwards the carriage; return to the original position
   Dosage: 10 reps; Tempo: slow; springs: 1 red; 1 blue;
7. Initial position: Sit on bosu, knees bent; a dumbbell hold in hands;
   Movement: rotating the trunk to the left, touching the ground with the dumbbell; Continue to repeat for each side;
   Dosage: 16 reps; tempo: fast; weighing: 1.5 kg;
8. Initial position: Sitting on carriage- sitting cross legs, the arms forward, hands in supination, straps in the hand;
9. Movement: Flexion and extension of arms;
   Dosage: 10 reps; Tempo: moderate; spring: 1 blue;
10. Initial position: Stand one feet away from bosu, arms around the body;
    Movement: One step forward with the left foot simultaneously with the straight arm; kick with right foot; Return to initial position; the same for the opposite side;

We mention that the reformer springs have different resistances: red - medium resistance; blue- 1/2 of red spring resistance; yellow- lightest resistance. Exercises no. 1, 2, 4, 5, 6, 8 have 4 different variants.

Results

Figure 1 follows the effort curve in a training lesson. Graphic representation indicates heart rate oscillations. For warm-up were allocate 7 minute of a total of 51 minutes, the heart rate values ranging from 71 to 130 bpm. The basic part of the training consists the exercise complex, with heart rate values ranging from 130 to 167 bpm. The last part of the lesson, the body's recovery after the effort, had a duration of 10 minutes and heart rate values were recorded between 133-82 bpm. The pulse tester also provided a graph with the effort zones: the first effort zone - under 115 bpm a recorded duration of 6 minutes and 27 seconds; second effort zone - moderate effort: 12 minutes and 25 seconds; third effort zone - optimal effort: 21 minutes and 48 seconds; four effort zone - intense effort: 4 minutes and 57 seconds; last effort zone, maximum effort - 0 minutes.

The Figure 2 shows the data provided by the pulse tester at the end of the training lesson: duration 51 minutes and 12 seconds, heart rate average 131 bpm, heart rate maxim 167 bpm, heart rate minim 71 bpm, number of calories consumed 278 kcal.

![Figure 1. The effort curve in a training lesson](image-url)
Figure 2. Training summary

Conclusions

Physical effort in training is addressed only to healthy people, trained or non-trained. To lead to a performance, even personal, effort management is imperative. The physical demand of the body during a motor activity implies a complex response from it translated into a series of reactions. An easy indicator to be analyzed during the lesson is heart rate.

Functional training involves an increase in efficiency of performing daily activities by transferring the effects obtained from physical exercises, involves the entire neuromuscular system, improves the fitness components and stimulate the metabolism.

References

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