BABEȘ-BOLYAI UNIVERSITY CLUJ-NAPOCA
FACULTY OF PHYSICAL EDUCATION AND SPORT
DOCTORAL SCHOOL

OTILIA TEODORA BURZ (married LIBER)

Contemporary dance practiced as a leisure time activity by 6-9 year old girls

PHD THESIS SUMMARY

PhD supervisor:
PROF. IACOB HANȚIU, PhD

2023

Content

Key words: recreational physical activities, contemporary dance, ballet movements, acrobatic elements, motor skills, attentional control

Motivation for the choice of theme

Contemporary dance is a current form of physical exercise, but in Romania there are many unknowns about how to teach it and how a workout should be conducted depending on the level of training of the students. This is mainly what led to the choice of this topic and consists in the desire to contribute to the realization of a contemporary dance exercise program for children.

Contemporary dance is a style of dance in which, in addition to the specific technique, elements of gymnastics can be performed, but in harmony with the music, dance technique and facial gestures, to help emphasise the transmission of a message. In choreography, the requirements for acrobatic elements are low compared to performance gymnastics, so not as much rigour is required. Also, the elements and their number are not limited, and the teacher is free to choose and combine them according to his or her own imagination to best convey the emotion or story of the dance. However, teaching this style of dance can be difficult for a graduate of the Faculty of Physical Education and Sport, even if they have previously practised artistic performance gymnastics or other dance genres, because the content of the training is different and contemporary dance is not a discipline taught in this faculty.

As far as our country is concerned, there are limited sources of information about designing a training plan or teaching methods for contemporary dance. Also, both nationally and internationally, there is confusion about what contemporary dance is called and what training should be about, and as a result trainers' opinions are divided, sometimes totally opposite. All these arguments contributed to the motivation for the choice of the topic in our research.

Importance and topicality of the theme

Most children start contemporary dance as a recreational activity, but there is a possibility that some may wish to continue at a competitive level. Even if the pupil has the physical aptitude for this sport/artistic discipline and enjoys it, due to a lack of optimal preparation, he/she cannot realise the potential in competitions and becomes disappointed with the performance and results. Given the limited research on the design of a contemporary dance training programme, this may be an impediment to the development of coaches and consequently also athletes. This indicates to us the particular importance of the chosen topic, as it is essential for teachers to have as many sources of information as possible to ensure their

children's progress and for them to benefit from the positive influence of practicing contemporary dance.

The review of the topic in the literature was largely based on information from electronic materials. The Romanian literature has been valuable in its content regarding the age particularities of children and the development of motor skills, but has limited information regarding the design of a contemporary dance training program, which is why foreign literature has been part of the main sources of exploration in previous research. In addition to findings from the field of physical education and sport, information has also been gathered from the fields of cultural arts as well as medicine and psychology.

Recreational physical activities have a transdisciplinary perspective because they are of particular interest to several fields of activity, due to their contribution to enhancing an individual's quality of life. Physical exercise is supported worldwide and promoted through events, television and the internet. All this indicates that research that argues in favour of recreational physical activity is a current topic, as it contributes to promoting health by avoiding sedentarism in favour of an active lifestyle.

On the other hand, studies on contemporary dance are topical because it is a growing and increasingly popular sport activity among children. Over the years, numerous studies have shown the importance of practising dance in various forms during childhood to improve quality of life.

Elements of novelty and originality

The innovation of our work consists in designing an exercise program and verifying its effects in recreational contemporary dance training for children aged 6-9 years. The motor skills of explosive strength of the lower limbs, strength of the abdominal muscles, flexibility, coordination and balance were targeted, as they are important in the physical development of young school children, but also in dance, as they facilitate the learning process of specific techniques. In this way beginners can master the movements with ease, not encountering physical difficulties that could cause self-disappointment (Roche & Huddy, 2015). At the same time, the aim was to analyze anthropometric indices, as well as cognitive development by assessing attention (inhibition and self-regulation) before and after practicing the exercises.

Another new element is the verification of the commercial EEG device MyndBand MyndPlay, which indicates a person's attention level based on brain activity. It provides real-time feedback that can be recorded and saved, and later interpreted by anyone.

The originality of this work is given by the broad approach to the methodology of the benefits of practicing contemporary dance and the methods of teaching it. On the other hand, the originality of the thesis is given by the personal contribution to the development of a 6-month training program for beginner children practicing recreational contemporary dance. All this information can be useful for the professional development of contemporary dance coaches, both from a theoretical and practical point of view.

The aim of the research

The aim of this research was to analyze the effect of a reactive contemporary dance training program on body composition, motor skills, balance and attention in girls aged 6 to 9 years.

The objectives of the research

The objectives of our study were:

- analyse the reflection of the topic in the literature;
- to develop a recreational contemporary dance training programme;
- verification of the intervention programme;
- verification of the instruments to measure the effects produced by the practice of training during the intervention period;
- analysis of the effects produced by the intervention programme on the development of contemporary dance-specific motor skills, anthropometric parameters and attentional control in 6-9 year old girls.

The content of the paper

The thesis is structured in three parts.

Part I consists of a review of the literature related to the research topic, which consists of five chapters. The first chapter highlights the arguments of specialists in favour of physical activity. Chapter 2 is devoted to the analysis of dance. Chapter 3 presents the somatic, functional and psychological particularities of young school-age children and Chapter 4 deals with the fundamental concepts of specific motor skills. Chapter 5 presents anthropometric measurement instruments, motor skills, technical elements and attentional control.

Part II of the paper presents two pilot studies. The first one was carried out in order to verify two intervention programs that facilitate the learning of an acrobatic element of

gymnastics practiced in contemporary dance. Due to the COVID-19 pandemic, it was not possible to continue the study, so we adapted the study theme to the subsequent conditions, which are presented in pilot study 2.

Part III of the thesis covers the experimental research. This was carried out over a period of 6 months, during which the intervention programme from pilot study 2 adapted to this time period was applied. Initial and final measurements were made and statistical analysis was made on the basis of the data collected, after which the discussions and conclusions of the research were formulated.

PARTEA I

RECENZIA LITERATURII DE SPECIALITATE AFERENTE CERCETĂRII

Chapter 1. Physical activities

Physical activity, according to Nicu et al. (2002, p. 26), is defined as "a type of human activity generally characterized by conscious, motivated movements, performed for different purposes either in work, sport, tourism, recreation (as an important part of leisure time)".

The Sedentary Behaviour Research Network, defines physical activity as "any movement of the body generated by the contraction of skeletal muscles that increases energy consumption above the resting metabolic rate and is characterised by the modality, frequency, intensity, duration and context of practice" (Thivel et al., 2018). Physical activities are recognised and promoted for increasing an individual's quality of life in several ways. As a result of their practice, in the long term benefits such as improvement of certain body functions and systems occur. They are also a primary means of preventing obesity, cardiovascular disease, cancer, diabetes, osteoporosis, and thus premature death (Hanțiu, 2010; Pedersen & Saltin, 2015; Warburton et al., 2006; World Health Organization, 2010).

However, according to the World Health Organisation, by 2022, children aged 11-17 in Romania will be less physically active than people aged 18-69 and over 70. Girls are also more physically inactive than boys (https://www.who.int/publications/i/item/9789240064119). These statistics are worrying given the alarming number of premature deaths due to physical inactivity.

Physical activity during childhood is positively associated with increased health and prolonged well-being (Huang et al., 2012). It is also during this period that the habit of being physically active is more easily established and the chances of lifelong physical activity are higher. This favours the maintenance of the individual's health (Dascal & Buruiană, 2020).

Health and motor skills are fundamental in the development of young people. Physical activity practised in an organised and constant way during leisure time has some functions in common with physical education and sport. Both are responsible for creating an environment conducive to fostering the development of the individual in order to increase the quality of life (Alecu, 2020).

Chapter 2. Dance as a form of physical activity

Dance is a form of physical activity that can be practised as a recreational, sporting, performance or therapeutic activity. It can also be used in multiple social settings such as weddings, discos and other parties, but also for entertainment in films, music videos, theatre performances, cabaret, etc. (Thomas, 2003; Nalett, 2005).

According to the dictionary of the Romanian language (DEX), dance is a "set of rhythmic, varied movements of the human body, performed to the rhythm of a melody, of different types" (https://dexonline.ro/definitie/dans). According to Proca-Ciortea (apud Stoicescu, 2021), it is "expression of forms of life in movement".

In human history, dance has taken many forms, being included in various rituals for social-religious manifestations, shamanism, flirting, fertility, hunting, war or as a ritual of passage through certain places (Payne & Costas, 2021). Malkogeorgos et al. (2011) suggest that nowadays the reasons for practicing dance are not completely unrecognized, but according to them and Graham (2002), the recognized ones are for performance, competition, socialization, entertainment, recreation, creativity, education, fitness, aesthetics, etc.

Dance is an art form through which individuals externalize their feelings and thoughts with the help of body expression, therefore, it is a natural way to control and express emotions (Payne & Costas, 2021). It can also be used as an exercise for connecting the body with the mind, thus fostering their coexistence in harmony (Payne & Costas, 2021; Seaman et al., 2017). According to the literature, this can lead to improvements in skills such as motor ability, coordination, balance, memory, language, communication, reading, mathematical skills and well-being (Dennison & Dennison, 2010; Hraste et al., 2015; Hraste et al., 2018).

Contemporary dance is a rapidly developing dance genre, evolved from modern dance, which emerged from the search for a free expression of feelings and ideas through expressiveness and movement that is as natural as possible (Lepecki, 2006). Ballet dancing was considered a rigid form with many restrictions, as a result the innovators of modern dance eliminated the pointes for greater lightness and used gravity to perform various leaps and jumps, but without completely abandoning the technique of ballet. Movements performed at ground level were also introduced (Limón, 1966). Contemporary dance today is a dance style that is based on at least one of the techniques of modern dance and can contain elements from gymnastics and influences from any other dance style, through which a story, idea, feeling or emotion can be expressed.

Chapter 3. Age particularities of children

Childhood is the period of life in which an individual goes through several stages in order to gradually evolve from newborn to adulthood (Sillamy, 2000). During this period, the process of growth and development takes place both from a morpho-functional, emotional and socio-cultural point of view (Sălceanu, 2015). According to Piaget & Inhelder (2005), development can be physical, socio-cultural and cognitive.

Executive functions are responsible for several cognitive abilities, as a result, they determine success or failure in people's lives (Shaheen, 2014). According to Aron (2008), executive functions "are at the peak of evolutionary and mental development". Their classification differs from author to author, but the process of attentional control is part of executive functions regardless of how they are systematized. An important factor in their development is the maturation of the prefrontal cortex, so executive functions, and thus attention, gradually improve with advancing age during childhood (Shaheen, 2014).

Chapter 4. Particularities of motor skills in children

Șiclovan (apud Dragnea et al., 2006), defines motor skills as "the body's attributes, materialized in the ability to perform movement actions with certain indices of strength, speed, skill and endurance". According to Cârstea (2000, p.50), motor skills are characteristics of human locomotion that are distinctive from birth and develop by themselves during life until a certain age, after which they follow a downward path. However, Leon (2010), indicates that the level of development of motor skills can be influenced by systematic exercise.

Cârstea (2000, p.50-51), classifies motor skills as basic (speed, endurance, coordination, strength and flexibility) and specific (which determine the level of performance in a particular sport discipline). In this research the motor skills of coordination, static balance, strength (in the abdominal and lower limb explosive strength muscles) and flexibility were targeted. These are basic in contemporary dance, but developing them to an optimal level is also important in everyday activities.

Chapter 5. Measuring instruments

According to Kuriyan (2018), anthropometric measurement methods are numerous and diversified in terms of duration, accuracy, level of difficulty in application and cost. Bioelectrical impedance analysis (BIA), is an anthropometric measurement method that assesses body composition using a monitor (Cosoveanu & Bulucea, 2011). Cichoż-Lach and Michalak (2017), indicate that this method is non-invasive, with high accuracy in estimating indices, it is easily applied and in a short time. Beaudart et al. (2020), suggest that the principle of this method is to evaluate the electrical resistance that the body shows, when electric current passes through it. Based on the speed of current flow, the total body water is determined, after which fat-free mass is calculated, using the assumption that 73% of this is water (Lee & Gallagher, 2008).

Motor skills can be tested through several tests that can be general or sport-specific. Over the years, batteries of tests have emerged, such as FitnessGram or EuroFit, which consists of assessing children's fitness through several tests, or single tests for a specific motor skill, such as the Matorin test (Brown & Lalor, 2009; Grgic, 2022; Kolimechkov et al., 2019; Wolf-Cvitak et al., 2002). For the assessment of static balance, according to Huurnink et al. (2013), the most efficient way is to measure the centre of pressure. A valid tool for its analysis is the Wii Balance Board (WBB), which belongs to the Wii Fit Nintendo active video game (Clark et al., 2010; Clark et al., 2018; Huurnink et al., 2013). To provide feedback on COP displacement, the WBB can connect to software, such as SeeSway which was created for educational purposes, but also to provide researchers with a way to explore balance simply and efficiently (Clark & Pua, 2018).

PART II

PILOT STUDIES ON THE VERIFICATION OF CONTEMPORARY DANCE INTERVENTION PROGRAMMES FOR 6-9 YEAR OLD CHILDREN AND MEASUREMENT TOOLS

Chapter 7. The impact of contemporary recreational dance on 6-9 year olds: Pilot Study 2

The aim of this study was to develop and analyze the effects of an intervention program that included recreational contemporary dance training in 6-9 year old children. At the same time, we also aimed to test the instruments to be used in future experimental research.

The objectives of this research were:

- establish and experiment the intervention programme;
- to verify the evaluation instruments in the measurements;
- to analyse the impact of the intervention programme on subjects.

7.2. Subjects

The study was done on a group of 16 female subjects, aged between 6 and 9 years. Participation was voluntary and their inclusion in the research was done following consent received from the parent/guardian by completing the informal consent form. Educational attainment was another criterion for inclusion in the study. The children were beginners, having practiced an out-of-school physical activity for the first time in an organized setting.

Subjects participated in an intervention program twice a week for one hour after the end of class.

7.3. Materials and Methods

The study took place in the sports hall of the Primary School No. 2 Stânceşti, in the commune of Buntești, Bihor County, over a period of 6 weeks. In the first and last week, initial/final measurements were taken and the intervention program was applied for 4 weeks, from September 20 to October 15, 2021. It consisted of practicing contemporary dance training twice a week for one hour on Tuesdays and Thursdays.

Research design

The exercises applied during the activity were different on the two days of the week, but the first part (preparing the body for effort and stretching exercises) and the last part (recovering the body for effort) were the same for both lessons.

Training 1 (T1) included:

- Preparing the body for effort;
- Stretching exercises;
- Exercises from ballet and artistic jumps;
- Body recovery after exercise.

Training 2 (T2) consisted of:

- Preparing the body for effort;
- Stretching exercises;
- Acrobatic elements;
- Body recovery after exercise.

The objectives of the lessons were: to improve motor skills, to learn the movement skills correctly, to increase or maintain interest in the tasks given, to perform the exercises with pleasure, to express joy and satisfaction for each success.

Given the level of training of the subjects, the complexity of the exercises was high. Therefore, we considered it important to keep the intensity low to moderate and to focus on the process of correct acquisition of motor skills. To implement this, out of a 60-minute training, 20-25 minutes were allocated in the first two weeks for explanations, demonstrations and for correcting possible mistakes in execution. In the last two weeks, the actual working time increased to 45-50 minutes.

Equipment and measurements made

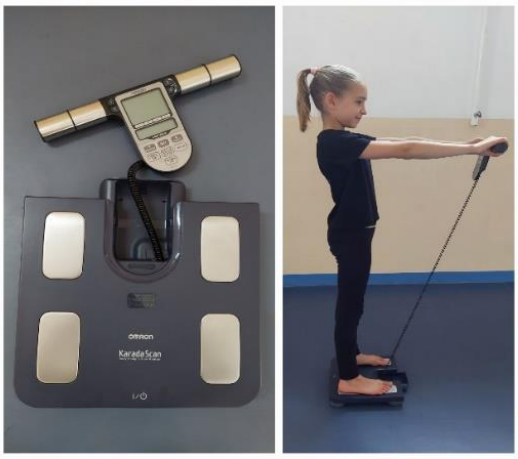
Description of anthropometric measurements

The anthropometric assessment tools were the thalliometer for measuring height (H) and the OMRON BF511, for measuring weight (W), percentage of body fat (BF) and skeletal muscle (SM) and body mass index (BMI).

Prior to measurement, OMRON is required to enter data about the subject, such as age, gender and height (ORMON, f. d.). Then, the measurement is performed in the sitting position on the device with the feet on the lower limb electrodes and the arms raised forward, with the upper limb sensors in the hands. These are connected to the apparatus by a cable (Figure 11).

Figure 11.

Body composition assessment monitor - OMORON BF511



Description of motor skills assessment measurements

The development of motor skills was assessed by:

- long jump from standing (LJ) to assess lower limb explosive strength;
- sit and rich test with right (S&R_RL) and left (S&R_LL) leg alternately extended forward to assess flexibility;
- Matorin test (Mat) for coordinative ability;
- sit - ups (S-U) for 1 minute was performed to assess abdominal muscle strength.

Balance was assessed using the Wii Balance Board (WBB) from the Nintendo game, but connected to SeeSway software, Ross Clark. The first test was standing on both legs shoulder-width apart (SBL) with arms at side of body, and the second, standing on one leg (SOL) with the free leg flexed from the knee joint and arms at side of body. In both trials the gaze was directed forward and the positions were held for 30 seconds each.

Connecting via bluetooth the WBB to the SeeSway software, gave us the possibility to observe in real time the COP oscillations (projection of the center of mass on the support surface).

After performing each sample, data were obtained for the following parameters: LCOP (length of the pressure centre path on the support surface), VCOP (velocity of the pressure centre path), VCOP_AP (velocity of the pressure centre path in the anterior-posterior plane), AmplAP (amplitude of the pressure centre displacement in the anterior-posterior plane), VCOP_ML (velocity of the pressure centre path in the medio-lateral plane) and AmplML (amplitude of the pressure centre displacement in the medio-lateral plane).

Description of the assessment of attention

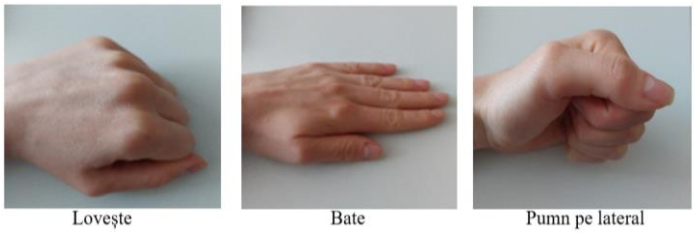
Subjects' attention levels were assessed by two different means, these being a commercial electroencephalograph (EEG) device and the neuropsychological Knock and Tap (K&T) test, which is part of the NEPSY test battery.

According to Korkman et al. (2007), the " Knock and Tap" is a subtest that belongs to the domain of attention, extended executive functions. It assesses the ability to self-regulate and inhibit by maintaining a cognitive set that involves suppressing visual actions and performing certain opposite motor acts. It is composed of two parts, and in the first part, when the examiner is knocking with his fist on the table, the child has to tap and knock when the examiner taps (Figure 12). This model of administration is used for items 1-15. During the test the subject must keep both hands on the table, but the preferred hand is used, while the opposite hand is relaxed with an open palm.

After the first part, the set changes and the child has to inhibit the learned motor response. On items 16-30, when the examiner knocks, the subject must place the fist laterally on the table (Figure 12) and knock when the examiner places the fist laterally, and on the open palm strike, the child must keep the hand still. Before starting the second part of the test, the examiner explains the new rules and applies a learning example.

Figure 12.

Hand actions in the K&T test



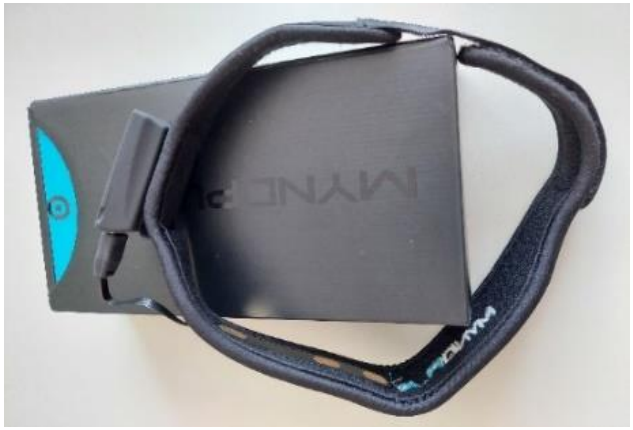
One point is awarded for each correct answer and the total score (TS) is the sum of the points from all items. The score can also be calculated separately for the first (SP1) and second parts (SP2) of the test. For this subtest, the total score is converted into specific percentiles according to the child's age. These are intended to identify child performance that is functioning below normal (Korkman et al., 2007).

K&T was performed while subjects wore an EEG device, which recorded brain wave values in real time. During the period when the examiner explained the rules of the second part of the test, EEG recording was stopped. The EEG device (Figure 13) is portable and is called

the MyndBand from the company MyndPlay. To observe and record the data transmitted by the EEG, MyndPlay Pro 2.12 software was used in this research and installed on the computer.

Figure 13.

MyndBand MyndPlay electroencephalograph device



MyndBand has its own scale measuring attention (At), calmness (Calm) and mental balance (MB), which is a combination of the first two (MyndPlay, f. d. b). By connecting the EEG device to the MyndPlay Pro V2 software, the recording of these scales can be observed as a graph or in numbers from 0 to 100. The higher the number, the higher the level.

In order to better understand the data provided by the MyndBand device, at the end of the experiment we decided to perform ten additional tests on one subject. Each of them were conducted on two sides and over the same time period, like the K&T subtest protocol.

Description of additional tests:

T1 - standing still

T2 - sitting still and talking

T3 - random movements during a conversation

T4 - eyebrow movements

T5 - bending head back and forth

T6 - left-right head twists

T7 - clumsy handwriting

T8 - K&T test with random head movements

T9 - K&T test without elbows on the table

T10 - the K&T test itself

7.4. Results

Anthropometric measurements

Table 13.

Mean, standard deviation and paired t-test for anthropometric parameters at measurements 1 and 2 (N = 16)

	Pair	UM	Mean	Standard Deviation	t	df	Sig. (2-tailed)	Effect Size (Cohen's D)
1	H_M1 H_M2	cm	131.19 133.13	8.34 8.48	9.08	15	0.000	2.27
2	W_M1 W_M2	kg	34.59 34.65	12.21 12.57	0.23	15	0.818	-
3	BMI_M1 BMI_M2	kg/cm²	19.66 19.04	4.95 4.85	-3.85	15	0.000	-0.06
4	BF_M1 BF_M2	%	25.98 23.62	11.16 11.13	-5.12	15	0.000	-0.96
5	SM_M1 SM_M2	%	28.31 29.36	1.61 1.58	9.36	15	0.000	-1.28

Note:
M1 = measurement 1, M2 - measurement 2, H = height, W = weight, BMI = body mass index, BF = body fat, SM = skeletal muscle

Motor skills assessments

Table 14.

Mean, standard deviation and paired t-test for variables SJ, Mat, S&R_RL, S&R_LL, S-U at measurements 1 and 2 (N = 16)

	Pair	UM	Mean	Standard Deviation	t	df	Sig. (2-tailed)	Effect Size (Cohen's D)
1	SJ_M1 SJ_M2	cm	87.00 91.81	12.97 15.22	3.40	15	0.004	0.85
2	Mat_M1 Mat_M2	degrees	185.63 240.63	15.37 43.58	5.49	15	0.000	1.37
3	S&R_RL_M1 S&R_RL_M2	cm	-1.81 2.13	5.84 4.84	5.03	15	0.000	1.26
4	S&R_LL_M1 S&R_LL_M2	cm	-2.94 1.50	5.43 5.25	7.42	15	0.000	1.85
5	S-U_M1 S-U_M2	nr	7.44 12.00	7.75 9.93	3.47	15	0.003	0.87

Note:
M1 = measurement 1, M2 - measurement 2, SJ = long jump, Mat = Matorin test, S&R_RL = sit and rich with right leg forward, S&R_LL = sit and rich with left leg forward, S-U = sit ups

Measurement of balance while standing on both legs

Following the collection of data from the SBL sample, descriptive statistics were performed for the following parameters: LCOP_M1 (M = 51.53, SD = 28.18), LCOP_M2 (M = 41.34, SD = 9.26), VCOP_M1 (M = 1.72, SD = 0.93), VCOP_M2 (M = 1.38, SD = 0.30), VCOP_AP_M1 (M = 1. 04, SD = 0.49), VCOP_AP_M2 (M = 0.89, SD = 0.30), AmplAP_M1 (M = 2.71, SD = 0.69), AmplAP_M2 (M = 2.60, SD = 1.83), VCOP_ML_M1 (M = 1. 11, SD = 0.72), VCOP_ML_M2 (M = 0.85, SD = 0.20), AmplML_M1 (M = 1.53, SD = 0.72), AmplML_M2 (M = 1.44, SD = 0.84).

According to the results of the paired t-test, no statistically significant difference was found between the initial and final measurement values for the SBL sample indices. The results suggest that the intervention period did not influence the balance in the two-legged stance.

Measurement of balance in one-legged stance

Following data collection from the SOL, descriptive statistics were performed for the following parameters: LCOP_M1 (M = 155.04, SD = 38.33), LCOP_M2 (M = 137.81, SD = 37.88), VCOP_M1 (M = 5.16, SD = 1.27), VCOP_M2 (M = 4.60, SD = 1.27), VCOP_AP_M1 (M = 3. 60, SD = 1.03), VCOP_AP_M2 (M = 3.03, SD = 1.18), AmplAP_M1 (M = 5.54, SD = 2.09), AmplAP_M2 (M = 6.83, SD = 7.15), VCOP_ML_M1 (M = 3. 58, SD = 1.54), VCOP_ML_M2 (M = 2.79, SD = 0.60), AmplML_M1 (M = 4.99, SD = 2.61), AmplML_M2 (M = 4.53, SD = 3.08).

Paired t-test was performed to compare the values between initial and final measurement of SOL parameters. A statistically significant difference was identified between the mean values of the parameters LCOP_M1 (M = 155.04, SD = 38.33) and LCOP_M2 (M = 137.81, SD = 37.88); t (15) = -2.20, p = 0.044.

A statistically significant difference was also identified between the means of the parameters VCOP_M1 (M = 5.16, SD = 1.27) and VCOP_M2 (M = 4.60, SD = 1.27); t (15) = -2.12, p = 0.051. Although the result of the t-test tells us that $p > 0.05$, if we reduce the number to two decimal places, it results in p = 0.05, which means that the difference between the initial and final measurement is statistically significant.

For the VCOP_AP, AmplAP, VCOP_ML and AmplML indices, no statistically significant difference was found between the initial and final values according to the paired t-test, where $p > 0.05$. These results suggest that the intervention period influenced LCOP and VCOP, but not VCOP_AP, AmplAp, VCOP_ML, AmplML, in the SOL sample.

Assessment of attention

Following data collection for the K&T attention assessment, the TS parameter showed a mean of 26.00 (SD = 2) at baseline and a mean of 27.81 (SD = 1.64) at endline. The SP1 parameter had a mean of 13.25 (SD = 1.24) at the first measurement and a mean of 4.31 (SD = 0.70) at the second measurement. At the same time, the mean of the SP2 parameter was 12.75 (SD = 1.39) at the initial measurement and 13.50 (SD = 1.26) at the final measurement.

Paired t-test was performed to compare the values of the Knock and Tap test parameters. A statistically significant difference was identified between the mean values of the TS_M1 (M = 26.00, SD = 2) and ST_M2 (M = 27.81, SD = 1.64) parameters; t (15) = 4.42, p = 0.001. A statistically significant difference was also identified between: SP1_M1 (M = 13.25, SD = 1.24) and SP1_M2 (M = 14.31 and SD = 0.70); t (15) = 2.87, p = 0.012. At the same time, when comparing means from the two measurements, a statistically significant difference was identified between: SP2_M1 (M = 12.75, SD = 1.39) and SP2_M2 (M = 13.50, SD = 1.26); t (15) = 2.09, p = 0.054. The paired t-test tells us that $p > 0.05$, but since the third decimal is less than 5, when we reduce the number to two decimal places, p equals 0.05.

These results suggest that the intervention period had a positive impact on subjects' attention levels, as shown by the results of the Knock and Tap test, where a statistically significant difference was identified between the initial and final measures on both the total score and the separate score on the first and second part of the test.

Following data collection from the initial measurement with the MyndBand EEG, descriptive statistics were performed for the AtP1 parameters (M = 63.36, SD = 17. 59), AtP2 (M = 56.64, SD = 13.99), CalmP1 (M = 63.16, SD = 9.93), CalmP2 (M = 61.72, SD = 12.03), MBP1 (M = 63.00, SD = 9.89), MBP2 (M = 58.93, SD = 10.57). Also, after collecting data from the final measurement, we performed descriptive statistics for the following parameters: AtP1 (M = 63.11, SD = 16.61), AtP2 (M = 62.45, SD = 12.10), CalmP1 (M = 63.32, SD = 12.54), CalmP2 (M = 60.71, SD = 7.75), MBP1 (M = 63.05, SD = 10.27), MBP2 (M = 61.52, SD = 7.73).

Paired t-test was performed to compare the values of the variables assessed with the EEG device. No statistically significant difference was identified between the values obtained at initial and final measurement. These results suggest that the intervention period did not influence the level of attention, calmness and mental state of balance between calmness and attention, according to the data collected with the MyndBand EEG device.

7.5. Discussion

Anthropometric assessment

According to the results, anthropometric parameters showed statistically significant differences following the intervention period, the exception being weight. However, the subjects are 6-9 years old and this age interval is part of the growth period which is characterized by changing anthropometric values. Therefore, it is possible that the changes may have occurred without the applied exercises, as they are due to the developmental period of the subjects.

However, according to Cáceres et al. (2018), skeletal muscles are poorly developed at early school age, with improvements only making their mark towards the end of this period. At the same time, body fat increases with advancing age (Hurgoiu et al., 2009). Given that our study showed a different evolution of muscle and fat mass development compared to the literature, we believe that the intervention program had an impact on body composition. Therefore, based on the results obtained for anthropometric parameters, we propose to implement a future study, over a longer duration of time, with a larger number of subjects and to include a control group, in order to verify whether somatic changes are determined by the applied program or by physical development characteristics.

At the same time, we believe that somatic measurement instruments can be applied in our research. The OMRON device displays measurements quickly and is easy to use for both researchers and subjects, even though some subjects had difficulty sitting still during the assessment.

Motor skills assessment

According to the results, the parameter values of the tests assessing motor skills showed statistically significant changes between the initial and final measurements, which means that abdominal muscle strength, lower limb explosive strength, coordination and flexibility were influenced by the intervention program. However, we consider that the study duration of only 4 weeks was too short to have an impact on the development of physical qualities. As a result, the improvements that occurred may be the consequence of practicing the exercises included in the training, which contributed to perform the movements required in the execution of the tests with greater ease and accuracy, leading to improved results. However, we are of the opinion that the application of the intervention programme over a longer period of time, with the same dosage and complexity, can contribute to the development of motor skills in girls aged 6-9 years.

The balance check by standing on both legs revealed low values of the displacement of the centre of pressure in all parameters, but these were not statistically significant. When assessing balance while standing on one leg, parameter values were found with positive and negative differences between the two measurements, some were statistically significant while others were not. These results were in agreement with those in the literature, which indicate us that there is a lack of meaning in the displacement of the center of pressure in 6-9 year old children (Bair et al., 2011; Ferronato & Barela, 2011; Figura et al., 1991; Garcia et al., 2011; Riach, Starkes, 1989; Riach & Starkes, 1994; Schärli et al., 2012; Stambolieva et al., 2012). The inclusion of a control group will help us to exclude age variables and verify the influence of the intervention program on postural control.

Assessment of attention

According to paired t-test results for K&T neuropsychological test parameters, attention increased following the intervention program. Qualitative interpretation of the data indicates that at the initial testing 9 subjects were at the borderline and 7 at the expected level. Progress following the intervention program is visible according to the results of the final measurements, where only 3 subjects remained classified at borderline and 13 at the expected level.

The values of the EEG attention measurement parameters showed changes following the intervention program, but according to the paired t-test they were not statistically significant ($p > 0.05$). At the same time, mean attention at the first part decreased following the intervention and increased at the second part. These results are in contradiction with those from the K&T test, which suggest that subjects' attention was higher on both parts.

The results of ten additional MyndBand EEG tests suggest that attention values were decreased when the subject was executing eyebrow movements or head twists, but this was not the case when the head was bent forward or backward. On the clumsy handwriting task, where greater concentration was required, attention values were lower compared to the test in which only head tilts were performed. These abrupt changes in values also existed between the first and second parts of the same test. The data for the parameters calmness and mental balance also had unexpected changes.

Although the MyndBand is a portable and easy to use instrument, the values given for the 3 parameters were not constant and fluctuated on similar or even identical tests. For these reasons, and because we could not find a specialist to help us with the interpretation of the results, we decided not to use the MyndBand MyndPlay device for attention assessment in future experimental research.

7.6. Conclusions

After interpreting the data, we concluded that the intervention program can contribute to changes in body composition, development of motor skills and improvement of attentional control. Including a control group and conducting the intervention over a longer period of time will help us to exclude age variables and verify the influence of contemporary dance on 6-9 year old girls.

Regarding anthropometric measurement instruments, as well as those for assessing motor skills, they have proven to be effective, simple to use and at the same time advantageous due to their low cost and portability. Subjects experienced no discomfort during the measurements, and problems encountered during the tests were minor and resolved on the spot. We consider that initially, subjects need to get used to the task and/or the equipment.

Analysis of the MyndBand EEG data showed low values of attention in the first part of the test and increased in the second part, these results differed from the K&T test, leading to further checking of the device. This revealed conflicting results, with large oscillations and no consistency in similar tests on the same subject. Therefore, we decided not to use the MyndBand MyndPlay device as a tool to check subjects' attention in the experimental research.

PART III

EXPERIMENTAL RESEARCH ON THE IMPACT OF CONTEMPORARY DANCE ON 6-9 YEAR OLD GIRLS

The aim of this study was to evaluate and analyse the effects of the intervention programme in pilot study 2, adapted to a 6-month period, on anthropometric indices, motor skills development and attention levels in 6-9 year old girls.

Study hypotheses:

We suppose that the practice of recreational contemporary dance by 6-9 year old girls for 6 months twice a week has an impact on body composition.

We suppose that the practice of recreational contemporary dance by 6-9 year old girls for 6 months, twice a week, influences the development of the motor skills lower limb explosive explosive strength, coordinative ability, flexibility, abdominal muscle strength and static balance.

We suppose that the practice of recreational contemporary dance by 6-9 year old girls for 6 months, twice a week, contributes to improved attentional control.

The objectives of the study were:

- adapt and implement the training plan from pilot study 2 over a 6-month period;
- to evaluate and analyse the effects of the intervention programme on anthropometric parameters, the development of specific motor skills and the level of attention in 6-9 year old girls.

8.2. Subjects

Twenty-six female subjects aged between 6 and 9 years voluntarily participated in the research, of which 12 were in the experimental group (EG) and 14 in the control group (CG). Participation in the experimental study was based on the completion of the consent form by a parent/guardian. Also, a main condition for participation was that girls had not previously practiced any extracurricular physical activity in an organized environment.

The subjects of the experimental group, were subjected to an intervention program, for 6 months, twice a week, while the subjects of the control group, did not practice any physical activity outside the physical education and sport classes at school.

8.3. Materials and Methods

The study was conducted from 29.11.2021 to 03.06.2022. Measurements were administered to both groups during the first part of the day, in the school premises where each subject studied, with the agreement of the teacher and the school management. The instruments used to carry out the measurements, and the conduct thereof, were the same as in pilot study 2, the exception being the attention assessment which was checked only by the " K&T" test.

Research design

The intervention programme took place in the sports hall of the "Nicolae Bolcaș" Vocational Pedagogical High School in Beiuș. In the first month, the training plan was identical to the one in pilot study 2. Given that this study was conducted over a longer period of time, after the first 4 weeks, the program underwent changes by replacing or supplementing it with other exercises. In the last month of intervention, after preparing the body for the effort, all training consisted in creating a choreography, by combining the teacher's ideas with those of the subjects. The choreography was presented in a dance show organised on the occasion of International Children's Day and at the end of the performance, each child received a medal and a diploma for participation.

8.4. Results

Anthropometric measurements

An independent samples t-test was performed to compare the values of anthropometric parameters for the experimental and control groups. No statistically significant difference was found at the initial measurement, which means that the two groups were homogeneous at the first measurement in terms of anthropometric indices.

Table 22.

Mean, standard deviation and paired t-test for anthropometric parameters in the experimental group at measurements 1 and 2 (N=12)

	Pair	UM	Mean	Standard Deviation	t	df	Sig. (2-tailed)	Effect Size (Cohen's D)
1	H_M1_EG H_ M2_EG	cm	124.67 129.25	6.44 6.21	9.18	11	0	2.65
2	W_ M1_EG W_ M2_EG	kg	28.55 30.48	6.24 6.71	4.95	11	0	1.43
3	BMI_M1_EG BMI_M2_EG	kg/cm²	18.19 18.08	2.85 2.88	-0.52	11	0.615	-
4	BF_ M1_EG BF_ M2_EG	%	24.10 22.53	7.05 6.59	-2.10	11	0.060	-
5	SM_M1_EG SM_M2_EG	%	27.89 29.69	2.10 1.71	7.23	11	0	2.09

Note:
M1 = measurement 1, M2 - measurement 2, EG = experimental group, H = height, W = weight, BMI = body mass index, BF = body fat, SM = skeletal muscle

Table 23.

Mean, standard deviation and paired t-test for anthropometric parameters in the control group at measurements 1 and 2 (N=14)

	Pair	UM	Mean	Standard Deviation	t	df	Sig. (2-tailed)	Effect Size (Cohen's D)
1	H_M1_ CG H_M2_CG	cm	126.71 130.21	5.22 5.41	8.41	13	0	2.25
2	W_ M1_ CG W_ M2_CG	kg	31.01 32.61	7.81 8.96	4.34	13	0.001	1.16
3	BMI_M1_CG BMI_M2_CG	kg/cm²	19.14 18.92	3.98 4.26	-1.22	13	0.243	-
4	BF_M1_CG BF_ M2_CG	%	25.16 23.94	10.56 11.12	-2.13	13	0.053	-0.57
5	SM_M1_CG SM_M2_CG	%	28.19 29.18	1.74 1.77	3.55	13	0.004	0.95

Note:
M1 = measurement 1, M2 - measurement 2, CG = control group, H = height, W = weight, BMI = body mass index, BF = body fat, SM = skeletal muscle

Motor skills assessments

Independent samples t-test was performed comparing SJ, Mat, S&R_RL, S&R_LL and S-U parameters between experiment and control group. According to the data in Table 24, at the initial measurement, a statistically significant difference was found between EG and CG for the parameters S&R_RL (t (19.40) = 4.04, p = 0.001) and S&R_LL (t (19) = 4.15, p = 0.001). These results suggest that the two groups were homogeneous at the beginning of the study in terms of the motor skills analysed, with the exception of the flexibility assessment tests.

Table 25.

Mean, standard deviation and paired t-test for the parameters SJ, Mat, S&R_RL, S&R_LL and S-U for the experimental group at measurements 1 and 2 (N=12)

	Pair	UM	Mean	Standard Deviation	t	df	Sig. (2-tailed)	Effect Size (Cohen's D)
1	SJ_M1_EG SJ_M2_EG	cm	87.25 100.33	13.30 12.62	2.80	11	0.017	0.81
2	Mat_M1_EG Mat_M2_EG	degrees	195.00 244.58	20.67 56.14	3.1	11	0.010	0.90
3	S&R_RL_M1_EG S&R_RL_M2_EG	cm	6.50 13.08	3.68 2.43	4.7	11	0.001	1.37
4	S&R_LL_M1_EG S&R_LL_M2_EG	cm	6.08 13.25	3.48 2.34	6.60	11	0.000	1.91
5	S-U_M1_EG S-U_M2_EG	nr	14.17 24.67	6.69 6.81	3.8	11	0.003	1.08

Note:
M1 = measurement 1, M2 - measurement 2, EG = experimental group, SJ = long jump, Mat = Matorin test, S&R_RL = sit and rich with right leg forward, S&R_LL = sit and rich with left leg forward, S-U = sit ups

Table 26.

Mean, standard deviation and paired t-test for the parameters SJ, Mat, S&R_RL, S&R_LL and S-U for the control group at measurements 1 and 2 (N=14)

	Pair	UM	Mean	Standard Deviation	t	df	Sig. (2-tailed)	Effect Size (Cohen's D)
1	SJ_M1_CG SJ_M2_CG	cm	79.71 86.71	15.81 14.97	1.95	13	0.073	-
2	Mat_M1_CG Mat_M2_CG	degrees	195.00 198.93	32.29 30.39	0.4	13	0.714	-
3	S&R_RL_M1_CG S&R_RL_M2_CG	cm	-2.71 0.14	7.56 4.59	3.2	13	0.007	0.85
4	S&R_LL_M1_CG S&R_LL_M2_CG	cm	-3.14 0.29	7.42 4.29	3.34	13	0.005	0.89
5	S-U_M1_CG S-U_M2_CG	nr	12.14 13.79	6.04 7.95	1.2	13	0.238	-

Note:
M1 = measurement 1, M2 - measurement 2, EC = control group, SJ = long jump, Mat = Matorin test, S&R_RL = sit and rich with right leg forward, S&R_LL = sit and rich with left leg forward, S-U = sit ups

Measurement of balance in the both legs standing position

The t-test for independent samples indicates that in the SBL test, the experimental and control groups were relatively homogeneous at the beginning of the research, except for the VCOP_ML parameter which showed a statistically significant difference (t (11.38) = 2.17, p = 0.052). Even though p is 0.052, when subtracting one decimal place, p = 0.05, therefore the difference is statistically significant.

Following the collection of data from the SBL sample in the experimental group, descriptive statistics were performed for the following parameters: LOCp_M1 (M = 79.92, SD = 58.15), LOCp_M2 (M = 42.31, SD = 7.75), VCp_M1 (M = 2.43, SD = 1.92), VCp_M2 (M = 1.40, SD = 0. 26), VCOP_AP_M1 (M = 1.51, SD = 1.22), VCOP_AP_M2 (M = 0.94, SD = 0.19), AmplAP_M1 (M = 6.27, SD = 11.93), AmplAP_M2 (M = 2.48, SD = 1. 01), VCOP_ML_M1 (M = 1.51, SD = 1.20), VCOP_ML_M2 (M = 0.86, SD = 0.22), AmplML_M1 (M = 4.83, SD = 8.17), AmplML_M2 (M = 1.42, SD = 0.41).

According to the paired t-test, in the experimental group indices for the SBL test, no statistically significant difference was found between the values obtained in the initial and final tests. These results suggest that balance on both legs was not influenced by the intervention program between the two measurements.

Following data collection from the control group on the SBL test, descriptive statistics were performed for the parameters LCOP_M1 (M = 38.66, SD = 7.76), LCOP_M2 (M = 38.66, SD = 9.28), VCOP_M1 (M = 1.29, SD = 0.26), VCOP_M2 (M = 1.29, SD = 0.32), VCOP_AP_M1 (M = 0. 86, SD = 0.24), VCOP_AP_M2 (M = 0.89, SD = 0.23), AmplAP_M1 (M = 2.54, SD = 1.06), AmplAP_M2 (M = 2.57, SD = 0.56), VCOP_ML_M1 (M = 0. 75, SD = 0.17), VCOP_ML_M2 (M = 0.74, SD = 0.21), AmplML_M1 (M = 1.31, SD = 0.54), AmplML_M2 (M = 1.50, SD = 0.68).

The paired t-test indicates that no statistically significant difference was found between the initial and final test values for the SBL sample. These results suggest that in the period between the two measurements the balance in the two-legged stance did not improve in the control group.

Measurement of balance in one-legged standing position

According to the independent samples t-test, at the SOL sample parameters, no statistically significant difference was identified between the experiment and control groups at the initial measurement, which means that the two groups were homogeneous at the first test.

Following the collection of data from the initial measurement of the experimental group

at the SOL sample, descriptive statistics were performed for the parameters: LCOP, (M = 224. 18, SD = 105.87), VCOP (M = 7.47, SD = 3.52), VCOP_AP (M = 5.35, SD = 2.93), AmplAP (M = 7.68, SD = 3.71), VCOP_ML (M = 4.13, SD = 1.68) and AmplML (M = 5.57, SD = 3.82). Descriptive statistics were also performed after collecting data from the final measurement for the following parameters: LCOP, (M = 146.51, SD = 32.76), VCOP (M = 4.89, SD = 1.08), VCOP_AP (M = 3.33, SD = 0.95), AmplAP (M = 5.17, SD = 1.51), VCOP_ML (M = 2.88, SD = 0.50) and AmplML (M = 3.13, SD = 0.45).

To compare the initial and final values of the SOL sample parameters, paired t-test was performed. Statistically significant differences were found between the means of the first and second test for all parameters analysed. These results suggest that the intervention program influenced the maintenance of balance in the one-legged standing position.

Descriptive statistics were performed for the following parameters of the one-legged balance test for the control group: LCOP_M1 (M = 176.49, SD = 131.27), LCOP_M2 (M = 146.44, SD = 46.69), VCOP_M1 (M = 5.89, SD = 4.37), VCOP_M2 (M = 4. 88, SD = 1.56), VCOP_AP_M1 (M = 4.11, SD = 4.02), VCOP_AP_M2 (M = 3.16, SD = 1.18), AmplAP_M1 (M = 5.81, SD = 3.21), AmplAP_M2 (M = 5.40, SD = 2. 22), VCOP_ML_M1 (M = 3.29, SD = 1.38), VCOP_ML_M2 (M = 3.04, SD = 0.91), AmplML_M1 (M = 4.15, SD = 1.77), AmplML_M2 (M = 4.52, SD = 2.00).

Following the paired t-test, no statistically significant difference was identified between the first and second measurements for the SOL sample parameters. These results suggest that maintaining balance in the one-legged stance showed no progress in the control group subjects.

Assessment of attention

Independent samples t-test was performed to compare the K&T attention test scores in the two groups. At the first test EG and CG were approximately at the same level as t (24) = 1.21, p = 0.240 in TS_M1, t (24) = 0.40, p = 0.692 in SP1_M1 and t (24) = 1.22, p = 0.236 in SP2_M1.

Table 34.

Mean, standard deviation and paired t-test for K&T test parameters in the experimental group at measurements 1 and 2 (N = 12)

	Pair	UM	Mean	Standard Deviation	t	df	Sig. (2-tailed)	Effect Size (Cohen's D)
1	ST_M1_EG ST_M2_EG	score	25.58 27.75	2.23 1.66	3.22	11	0.008	0.93
2	SP1_M1_EG SP1_M2_EG	score	12.92 14.08	1.38 1.31	2.31	11	0.041	0.67
3	SP2_M1_EG SP2_M2_EG	score	12.67 13.67	1.50 0.78	2.45	11	0.032	0.71

Note:
M1 = measurement 1, M2 = measurement 2, EG = experimental group, TS = total score, SP1 = score of the first part, SP2 = score of the second part.

Table 35.

Mean, standard deviation and paired t-test for K&T test parameters in the control group at measurements 1 and 2 (N = 14)

	Pair	UM	Mean	Standard Deviation	t	df	Sig. (2-tailed)
1	SBT_CG_M1 SBT_CG_M2	Punctaj	24.29 25.14	3.10 4.11	0.88	13	0.396
2	SBP1_CG_M1 SBP1_CG_M2	punctaj	12.64 13.29	1.98 2.13	0.86	13	0.404
3	SBP2_CG_M1 SBP2_CG_M2	punctaj	11.64 11.86	2.56 2.38	0.39	13	0.706

Note:
M1 = measurement 1, M2 = measurement 2, CG = control group, TS = total score, SP1 = score of the first part, SP2 = score of the second part

8.5. Discussions

According to the results of the anthropometric parameters, both groups showed similar or greater changes to the control group, which means that the exercise program implemented to the experimental group, did not have an impact on body composition. Therefore, we consider that the period of growth and development specific to young school age is responsible for the somatic changes of the subjects.

The results recorded in the motor skills assessment tests indicated that the exercise programme contributed to their development as statistically significant differences were identified following the intervention programme only in the experimental group, with the exception of flexibility. This changed statistically significantly in both groups, but the increase was greater in the experimental group, which means that the exercises practiced had an impact on the children's flexibility level. The changes in the control group may be due to the exercises

in the physical education lessons at school, but also to the age, which is conducive to its development. Therefore, the training in the intervention programme can contribute to the development of the motor skills of flexibility, general coordination, abdominal muscle strength and lower limb explosive strength in 6-9 year old girls.

Postural control in the SBL test showed no statistically significant changes in values in either group, meaning that balance in standing on both legs was not influenced by the intervention period. These results are in line with the literature suggesting that ballet exercises contribute to the development of the balance needed to perform specific tasks, which is not transferable (Hugel et al., 1999; Giboin et al., 2015), and that the position of standing on both feet shoulder-width apart with the feet parallel to each other is a common position that is not characteristic of ballet. However, the experimental group showed progress on all variables, while the control group had improvements only in the velocity of COP movement in the medio-lateral plane. Total path and COP displacement velocity at CG had identical results on both measurements, meaning that it stagnated, and ML velocity and amplitude in both planes regressed following the intervention. Therefore, we consider that the training had an impact on postural control in the standing position on both legs, but it was not large.

In the one-legged standing test, the values decreased statistically significantly for all variables in the EG, while in the CG, the differences were statistically insignificant, meaning that the exercises in the intervention influenced the development of balance on one leg, a position commonly used in ballet and contemporary dance for both static and dynamic elements. Therefore, it can be concluded that the program implemented for a period of 6 months influenced the development of static balance, but the effects were greater on the balance specific to contemporary dance.

The results of the K&T test, which assessed attentional control, suggest that both groups showed increases in values between the two measurements. These results were to be expected given that attention improves concomitantly with the maturation of the prefrontal cortex, thus in children, as they get older (Shaheen, 2014). However, the difference in values from the two tests was greater in EG than in CG, both in the total score (2.17 compared to 0.85) and in the score from the first (1.16 in EG and 0.65 in CG) and second (1.00 compared to 0.22) parts of the test, analyzed separately. Also, the qualitative interpretation of the K&T test data indicates that the subjects of the experimental group made more progress than those of the control group. At the same time, the paired t-test confirms this by identifying statistically significant differences for the K&T test parameter only in the EG following the intervention. As a result,

we believe that recreational contemporary dance training, may influence the development of attention in 6-9 year old girls.

8.7. Conclusions

After interpreting the results, we concluded that recreational contemporary dance training practiced for 6 months, twice a week, did not influence anthropometric indices, but contributed to the development of specific motor skills and attentional control in girls aged 6 to 9 years. Thus, on the one side the hypothesis of the study is confirmed in view of the impact of training on the level of development of motor skills and attentional skills, but it is not confirmed in regard to the influence on growth and physical development.

Chapter 9. General conclusions of the research

Recreational contemporary dance training can influence the development of specific motor skills and attentional control in 6-9 year old girls, but has no impact on anthropometric indices.

We believe that the developed intervention program, contributes to the improvement of contemporary dance methodology for beginner level children. At the same time, it can be useful for trainers aiming at developing specific motor skills and improving cognitive skills, especially attentional control.

We propose future research to test the effects of contemporary dance on different age groups, training levels and over a longer period of time.

Selected Bibliography

Acker, R. V., Bourdeaudhuu, I. D., Martelaer, K. D., Seghers, J., Cocker, K. D., & Cardon, G. (2012). The association between socio-ecological factors and having an after-school physical activity program. *Journal of school health*, 82(9), 395-403. doi:10.1111/j.1746-1561.2012.00711.x

Alecu, A. (2020). *Activități motrice de timp liber: Sporturi nautice kaiacul și canoea*. Editura Universității din Pitești

Alpkaya, U. (2013). The effects of basic gymnastics training integrated with physical education courses on selected motor performance variables. *Educational Research and Reviews*, *8*(7), 317. https://pdfs.semanticscholar.org/3f10/3a014fa637d7eb16e230e143a10577cd550a.pdf

Baritz, M. I., & Balcu, I. (2015). Studiul posturii în echilibrul bipodal dezvoltat în manevrarile tehnologice de tip pull/push / Posture study in bipodal equilibrium developed in technological actions type pull/push. *Sinteze de Mecanica Teoretica si Aplicata*, *6*(1), 43. http://www.smta.ro/reviste/articole/vol6nr1art5.pdf

Barton, E. J. (2011). Movement and Mindfulness: A Formative Evaluation of a Dance/Movement and Yoga Therapy Program with Participants Experiencing Severe Mental Illness. *Am J Dance Ther* 33:157–181 DOI 10.1007/s10465-011-9121-7

Bégel, V., Bachrach, A., Dalla Bella, S., Laroche, J., Clément, S., Riquet, A., & Dellacherie, D. (2022). Dance improves motor, cognitive, and social skills in children with developmental cerebellar anomalies. *The Cerebellum*, *21*(2), 264-279. https://doi.org/10.1007/s12311-021-01291-2

Bélair, M-A, Kohen D.E., & Kingsbury, M. (2018). Relationship between leisure time physical activity, sedentary behaviour and symptoms of depression and anxiety: evidence from a populationbased sample of Canadian adolescents. *BMJ Open*; 8:e021119. http://dx.doi.org/10.1136/bmjopen-2017-021119

Bell, M. A., & Deater-Deckard, K. (2007). Biological systems and the development of self-regulation: Integrating behavior, genetics, and psychophysiology. *Journal of Developmental & Behavioral Pediatrics*, *28*(5), 409-420. DOI: 10.1097/DBP.0b013e3181131fc7

dx.doi.org/10.4067/S0370-41062018005001004

Carabet, N. (2019). Dezvoltarea fizică generală a preșcolarilor prin coordonarea mișcărilor. In Unicitate şi diversitate prin folclor (pp. 54-66). CZU: 373.2.02:796.015(478) https://ibn.idsi.md/vizualizare_articol/99503

Carey, K., Moran, A., & Rooney, B. (2019). Learning choreography: An investigation of motor imagery, attentional effort, and expertise in modern dance. *Frontiers in Psychology*, *10*, 422. https://doi.org/10.3389/fpsyg.2019.00422

Carnevale Pellino, V., Giuriato, M., Ceccarelli, G., Codella, R., Vandoni, M., Lovecchio, N., & Nevill, A. M. (2020). Explosive Strength Modeling in Children: Trends According to Growth and Prediction Equation. *Applied Sciences*, 10(18), 6430. MDPI AG. http://dx.doi.org/10.3390/app10186430

de Castro, J. A. C., de Lima, T. R., & Silva, D. A. S. (2018). Body composition estimation in children and adolescents by bioelectrical impedance analysis: A systematic review. *Journal of bodywork and movement therapies*, *22*(1), 134-146. https://doi.org/10.1016/j.jbmt.2017.04.010

Cârstea, G. (2000). *Teoria și metodică educației fizice și sportului: Pentru examenele de definitvat și gradul didactic II*. Editura AN-DA

Cejudo, A., Sánchez-Castillo, S., Sainz de Baranda, P., Gámez, J. C., & Santonja-Medina, F. (2019). Low range of shoulders horizontal abduction predisposes for shoulder pain in competitive young swimmers. *Frontiers in psychology*, 10, 478. https://doi.org/10.3389/fpsyg.2019.00478

Donti, O., Konrad, A., Panidi, I., Dinas, P. C., & Bogdanis, G. C. (2022). Is There a "Window of Opportunity" for Flexibility Development in Youth? A Systematic Review with Meta-analysis. *Sports medicine-open*, 8(1), 1-24. https://doi.org/10.1186/s40798-022-00476-1

Douda, H. T., Toubekis, A. G., Avloniti, A. A., & Tokmakidis, S. P. (2008). Physiological and anthropometric determinants of rhythmic gymnastics performance. *International Journal of Sports Physiology and Performance*, 3(1), 41-54. https://doi.org/10.1123/ijspp.3.1.41

Dowrick, P. W. (1991). *Practical guide to using video in the behavioral sciences*. John Wiley & Sons.

Dragnea, A., (1996). Antrenamentul sportiv – teorie și metodică, Editura Didactică și Pedagogică

Dragnea, A., Bota, A., (1999). *Teoria activităţilor motrice,* Editura Didactică și pedagogică RA

Dragnea, A., Bota, A., Teodorescu, S., Stănescu M., Șerbănoi, S., & Tudor, V. (2006). *Educație fizică și sport: Teorie și didactică*. Editura FEST

https://doi.org/10.1123/jsep.31.4.469

Evans, B., Tiburzi, A., & Norton, C. (1985). Body Composition and Body Type of Female Dance Majors. *Dance Research Journal*, 17(1), 17-20. DOI:10.2307/1478217

Eyssartier, C., Poulet, Y., Marsan, T., Valdes-Tamayo, L., El Oujaji, S., Robert, M., Billard, P., Thoreux, P., & Sauret, C. (2020). Contribution of hip extension and lumbar lordosis during back walkover performed by rhythmic and woman artistic gymnasts: a preliminary study. *Computer Methods in Biomechanics and Biomedical Engineering*, *23*(sup1), S101-S103. https://doi.org/10.1080/10255842.2020.1812841

Faigenbaum, A. D., Milliken, L. A., Loud, R. L., Burak, B. T., Doherty, C. L., & Westcott, W. L. (2002). Comparison of 1 and 2 days per week of strength training in children. *Research quarterly for exercise and sport*, 73(4), 416-424. https://doi.org/10.1080/02701367.2002.10609041

Falk, B., Sadres, E., Constantini, N., Zigel, L., Lidor, R., & Eliakim, A. (2002). The association between adiposity and the response to resistance training among pre-and early-pubertal boys. *Journal of Pediatric Endocrinology and Metabolism*, *15*(5), 597-606. https://doi.org/10.1515/JPEM.2002.15.5.597

Ferber-Viart, C., Ionescu, E., Morlet, T., Froehlich, P., & Dubreuil, C. (2007). Balance in healthy individuals assessed with Equitest: maturation and normative data for children and young adults. *International journal of pediatric otorhinolaryngology*, *71*(7), 1041-1046. https://doi.org/10.1016/j.ijporl.2007.03.012

Gallotta, M. C., Emerenziani, G. P., Franciosi, E., Meucci, M., Guidetti, L., & Baldari, C. (2015). Acute physical activity and delayed attention in primary school students. *Scandinavian journal of medicine & science in sports*, 25(3), e331-e338. https://doi.org/10.1111/sms.12310

Ganley, K. J., & Powers, C. M. (2005). Gait kinematics and kinetics of 7-year-old children: a comparison to adults using age-specific anthropometric data. *Gait & posture*, *21*(2), 141-145. https://doi.org/10.1016/j.gaitpost.2004.01.007

Grgic, J. (2022). Test–retest reliability of the EUROFIT test battery: A review. *Sport Sciences for Health*, 1-8. https://doi.org/10.1007/s11332-022-00936-x

de Haart, M., Geurts, A. C., Huidekoper, S. C., Fasotti, L., & van Limbeek, J. (2004). Recovery of standing balance in postacute stroke patients: a rehabilitation cohort study. *Archives of physical medicine and rehabilitation*, *85*(6), 886-895. https://doi.org/10.1016/j.apmr.2003.05.012

Hajer, G. R., Van Haeften, T. W., & Visseren, F. L. (2008). Adipose tissue dysfunction in obesity, diabetes, and vascular diseases. *European heart journal*, *29*(24), 2959-2971. https://doi.org/10.1093/eurheartj/ehn387

Hallberg, D. (2017). *A body of work: Dance to the edge and back*. Simon & Schuster. https://scholar.google.com/scholar_lookup?title=A+body+of+work%3A+Dance+to+the+edge+and+back&author=D.+Hallberg&publication_year=2017

Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development*. FT press.

Kolimechkov, S., Petrov, L., & Alexandrova, A. (2019). Alpha-fit test battery norms for children and adolescents from 5 to 18 years of age obtained by a linear interpolation of existing european physical fitness references. *European Journal of Physical Education and Sport Science*, *5*(4), 1-14. https://oapub.org/edu/index.php/ejep/article/view/2221

Korkman, M., Kirk, U., & Kemp, S. (2007). *Nepsy: Evaluarea neuropsihologică a dezvoltării: Manual*. Cognitrom

Koutedakis, Y., Stavropoulos-Kalinoglou, A., & Metsios, G. (2005). The significance of muscular strength in dance. *Journal of dance medicine & science*, 9(1), 29-34. http://hdl.handle.net/2436/35452

Lloyd, R. S., & Oliver, J. L. (2012). The youth physical development model: A new approach to long-term athletic development. *Strength & Conditioning Journal*, 34(3), 61-72. DOI: 10.1519/SSC.0b013e31825760ea

Lohman, T. G. (1989). Assessment of body composition in children. *Pediatric Exercise Science*, *1*(1), 19-30. https://doi.org/10.1123/pes.1.1.19

McMahon, S. D., Rose, D. S., & Parks, M. (2003). Basic reading through dance program: The impact on first-grade students' basic reading skills. *Evaluation Review*, 27(1), 104-125. https://doi.org/10.1177/0193841X02239021

McKechnie, S., & Stevens, C. J. (2009). Visible thought: Choreographic cognition in creating, performing, and watching contemporary dance. *Contemporary choreography: A critical reader*, 38-51. http://handle.uws.edu.au:8081/1959.7/556560

Meltzer, L. (Ed.). (2018). *Executive function in education: From theory to practice*. Guilford Publications. https://scholar.google.com/scholar?cluster=14242778155306568335&hl=ro&as_sdt=0,5

Nintendo (f. d.). Wii Fit Plus: Instruction Booklet.

O'Connell, M., George, K., & Stock, D. (1998). Postural sway and balance testing: a comparison of normal and anterior cruciate ligament deficient knees. *Gait & posture*, *8*(2), 136-142. https://doi.org/10.1016/S0966-6362(98)00023-X

O'Donoghue, P. (2006). The use of feedback videos in sport. *International Journal of Performance Analysis in Sport*, *6*(2), 1-14. https://doi.org/10.1080/24748668.2006.11868368

OMRON (f. d.). Body Composition Monitor BF511 (HBF-511T-E/HBF-511B-E): Instruction Manual.

TajDini, M., Sokolov, V., Kuzminykh, I., Shiaeles, S., & Ghita, B. (2020). Wireless sensors for brain activity—a survey. *Electronics*, *9*(12), 2092. https://doi.org/10.3390/electronics9122092

Theodorakou, K., & Zervas, Y. (2003). The effects of the creative movement teaching method and the traditional teaching method on elementary school children's self-esteem. *Sport, Education and Society*, 8(1), 91-104. https://doi.org/10.1080/1357332032000050088

Thomas, H. (2003). *Dance, modernity and culture: Explorations in the sociology of dance*. Routledge. London and New York

Thivel, D., Tremblay, A., Genin, P. M., Panahi, S., Rivière, D., & Duclos, M. (2018). Physical activity, inactivity, and sedentary behaviors: definitions and implications in occupational health. *Frontiers in public health*, *6*, 288. https://doi.org/10.3389/fpubh.2018.00288

Verbecque, E., Vereeck, L., & Hallemans, A. (2016). Postural sway in children: A literature review. *Gait & posture*, *49*, 402-410. https://doi.org/10.1016/j.gaitpost.2016.08.003

Verza, E., & Verza, F. E. (2000). *Psihologia vârstelor*. Editura Pro Humanitate.

Zahl, T., Steinsbekk, S., & Wichstrøm, L. (2017). Physical Activity, Sedentary Behavior, and Symptoms of Major Depression in Middle Childhood. *Pediatrics.*139(2):e20161711. https://doi.org/10.1542/peds.2016-1711

Иванов, В. Д. (2020). Gymnastics, stretching and pilates system: effective flexibility development systems. *Физическая культура. Спорт. Туризм. Двигательная рекреация*, *5*(3), 115-119. https://orcid.org/0000-0002-2952-3222

www.kinovea.org: 22.02.2023

https://www.who.int/publications/i/item/9789240064119: 06.02.2023

https://www.who.int/health-topics/physical-activity#tab=tab_3: 06.02.2023

https://www.edu.ro/educatie-non-formala-informala: 07.02.2023