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# THE PLACE OF PHYSICAL EDUCATION SUBJECT AND CURRICULA DEVELOPMENT OF THE SLOVAK SCHOOLS

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**Summary**: The author of this contribution deals with the theory of tuition plans in which the subject Physical Education appears. Furthermore gives us exact description of some of plans concerning the history of education on the territory of today's Slovakia. It refers to the hourly time for teaching physical education in tuition plan in various historical periods of the Slovak education. The time planned for teaching physical education was usually 2 hours in the plans included in this article, what represents from 6.3 % to 10 % of time for teaching in a week in the different grades and different curricula.

Up to present, in the secondary school curriculum which was created in 1996, three hours for teaching physical education were determined, but these three hours mean only 6.4 % to 6.6 % of hours for weakly pupils´ learning in various grades in the curriculum.

**Key words**: tuition plans, physical education, school reforms of Marie-Therese, bourgeois schools, Czechoslovak schools, hour subsidy of physical education

## Introduction

The school is a social institution, where the priority is education and transmission of traditions and cultural values of the society, which had to be learned and developed by the next generation.

Unitary trend in the creation of school projects allows smooth transition from one educational level to another and provides equal opportunities to obtain secondary and university education (uniform school). Tuition plan is the main document to outline the objectives of teaching content. Decisive influences on creation of the curriculum are the requirements and needs of society, development of scientific knowledge and cultural policy of the state (Pedagogická encyklopédia, 1984 – 1985). Tuition plans are usually issued together with the curriculum and they are changed when a new education law and a new school reform are issued.

## Objective

The aim of this article is to extend the knowledge of the development of school curriculum in our history and the place of subject physical education in them.

## Theory of tuition plan

A tuition plan is the basic didactic standard ensuring selection of subjects for a certain kind of school as well as determining the number of lessons per week for the subject and grade in question. It specifies the content of education by means of a set of subjects, their arrangement by grades and number of lessons. The term "subject" was defined by Kulacs (1985) as follows: "The term "subject" relates to a relatively homogenous group of educational content set on the basis of science, technology and art as well as on certain forms of activities of social interest, while applying certain pedagogical-didactic aspects and requirements." Its inner structure is determined by a set of educational objectives with regard to biological, psychological and pedagogical elements of education.

The tuition plan is the basis for the curriculum and timetable. Selection and structure of teaching subjects in the curriculum is carried out in accordance with the goals of education (Průcha, Walterová, Mareš, 1998).

The tuition plan (Petlák, 1997) is the basic school document issued by the Ministry of Education that contains the list of subjects taught in the given type of school. It specifies the number of lessons per week and in total for the relevant subject and grade. It contains compulsory, compulsorily optional and optional subjects. Subjects contained in a tuition plan are systematically arranged according to individual school years.

From the aspect of content, subjects may be divided to following groups: social sciences, natural sciences, languages, aesthetics, physical education, work education. It is a very complex task to compose a tuition plan.

Melicher (2001) describes the tuition plan as a basic document containing a complete specification of subjects according to individual types of schools and numbers of lessons in a week to individual grades. It specifies also the number of lessons per week, the total number of lessons of individual subjects in the course of study at the relevant type of school as well as the overall number of lessons. A tuition plan is binding document for state schools as well as for private and church school accreditation.

The tuition plan is a document that defines the extension and content of education, determines the teaching (learning) subjects, their sequence according to grades, as well as the number of lessons per week. The first records on defining the content of education in the schools in Slovakia was found in the 16$^{th}$ century in the study regulations and school systems rules (Vajcik, 1955). The medieval schools were characterized by progressive tuition plans and curriculum; students receive first class grammar, then rhetoric and dialectic.

Centralised Theresian reforms brought unification tendencies towards organisation and content of tuition (school reforms of Marie-Therese).

On 2 August 1777, Marie-Therese approved the submitted special Hungarian standard: Ratio educationis publicae totiusgue rei litterarie per regnum Hungariae et provincias eidem adnexas, tomus I. Vindobonae 1777 (System of public education involving all schools in Hungarian monarchy and affiliated provinces, Volume I, Vienna 1777.). It was the first general education reform under the state initiative in which all school levels were reformed by Ratio educationis (Brťková, 1995).

Ratio educationis contains a universal school system from primary schools to universities. In addition to the school system organisation, this document also includes the study and disciplinary guidelines, physical, rational and ethical education standards and administrative regulations.

A. F. Kollár tried to put into practise teaching of mother tongue and the right to educate for all nationalities in the monarchy. Under Ratio, education was aimed at the citizen with extra attention paid to physical education. However, Ratio did not specify compulsory education. It was only in 1788 when Joseph II enacted the compulsory education from the age of 6 to 12, and related sanctions (Reble, 1993). The objectives and contents of education set in Ratio educations were of utilitarian character, having regard to the needs of employment of individual classes of society.

Other important representative who supported teaching physical education as a compulsory school subject was Ján Kollár. He as a Ministry advisor in Vienna was ensured to draw up a proposal to address school issues – in 1849, he had to propose the Plan for Reorganisation of the Slovak Education. The Plan ought to solve the requirements of the Slovak National Movement, which was expressed in the Slovak National Requests for Development of the Slovak education (Srogoň, Cach, Mátej, Schubert, 1981). A relatively progressive system of national education (folk and burgher schools) was created by the School Act of 1869, establishing compulsory education for children between the age of 6 and 14 and determining the objective and content of education, bearing in mind the teachers' education concerning the special teachers´ training courses (Somr a kol., 1987). The requirements for the introduction of physical education in school were postulated.

## Tuition plans of bourgeois schools

Tuition plans and syllabi of bourgeois schools were specified more exactly in the second half of the 19$^{th}$ century at Gymnasium (secondary school) and Realschule Acts of 1851 and 1883, respectively, Public (folk and burgher) School Act of 1868 (Tab. 1) and its amendment of 1882.

The tuition plan forms the basis of syllabi and timetable compilation. Individual subjects in the tuition plan are selected and structured in compliance with the educational objective and the number of lessons per week is given also under this idea (Pedagogická encyklopédia, 1984 – 1985).

There were 2 lessons for teaching physical education in the general tuition plan from the year 1868 in Hungary. These 2 lessons mean 10 % of the time for weakly all subjects teaching in the first and second grades and only 8.3 % of the time for weakly all subjects teaching in the third, fourth, fifth and sixth grades.

Strong personality and educational pioneer in teaching physical education at that time in our country was generalist PhDr. Ivan Branislav Zoch, who taught at the Lutheran Slovak Gymnasium in the former Great Revúca (www.osobnosti.sk). This secondary school offered the student the first facultative teaching of physical education at such a high level as Hungary was not aware of. During his stay at gymnasium he wrote a textbook of physical education, first in Slovakia, entitled "A short guide to teaching physical exercises, especially for primary schools". It contains 140 drawings – all drawn by him self. Except of floor

exercises there were also the gymnastic tools, athletic disciplines, folk dancing, games and hiking were added. He tried to reach the complexity and versatility.

***Table 1***

*General public school tuition plan in Hungary* (1868)*

| **SUBJECT** | **Class and number of lessons** | | | | | | **Number of teachers in school** |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | |
| Speech and brain training | 3 | 3 | – | – | – | – | 4 – 6 |
| Reading and writing | 8 | 6 | 6 | 5 | 3 | 3 | 6 |
| Grammar | – | 2 | 4 | 5 | – | – | 6 |
| Arithmetic | 5 | 5 | 5 | 5 | 4 | 5 | 6 |
| Geography | – | – | 2 | 2 | 2 | – | 6 |
| History and civil law | – | – | – | – | 3 | 3 | 6 |
| Natural science | – | – | – | – | 2 | 3 | 6 |
| Natural and physical sciences | – | – | – | – | 3 | 3 | 6 |
| Singing | 2 | 2 | 2 | 2 | 2 | 2 | 6 |
| Physical education | 2 | 2 | 2 | 2 | 2 | 2 | 6 |
| Art | – | – | 3 | 3 | 3 | 3 | 6 |
| Farming, gardening and housekeeping | On Wednesday and Saturday afternoon | | | | | | |
| Number of lessons per week | 20 | 20 | 24 | 24 | 24 | 24 | |

** The document on the new content of education under the School Act of 1868 "Učebný nákres pre národnie školy v zmysle zákonného článku XXXVIII z roku 1868" was published in Slovak language in Listy národných učiteľov, Volume II, 1869, 30.9.1869.*

The next period was marked by reformism resulting in the "Proposal of the Normal Syllabi for Experimental Burgher Schools" of 1930 that was applied only to certain schools. Definitive national tuition plans and syllabi for burgher schools were approved in 1932, for public schools, Gymnasiums (classical, real, reformed real) and Realschule in 1933 (Buzek, 1935). Teaching physical education in this plan involves 2 hours a week (Tab. 2). This represents 7.4 % of the hour subsidy of the subjects to be taught in the tuition plan for the first year of the secondary schools, 7.1 % for the second and. 6.6 % for the third and the fourth year of the study.

***Table 2***

*1933 tuition plan for Gymnasium grades 1 – 4 **

| SUBJECT | Class and number of lessons | | | | TOTAL |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | |
| Religion | 2 | 2 | 2 | 1 (2) | 7 (8) |
| Language-in which lessons are held | 5 | 5 | 4 | 4 | 18 |
| German language at Czechoslovak institutions, "Czechoslovak" language at other-language institutions | 4 | 4 | 3 | 3 | 14 |
| Latin | – | – | 6 | 6 | 12 |
| French (experimentally also English) | – | – | 5 | 5 | 10 |
| History | 1 | 2 | 2 | 2 | 7 |
| Geography | 2 | 2 | 2 | 2 | 8 |
| Mathematics | 4 | 4 | 3 | 3 | 14 |
| Natural science | 3 | 3 | – | – | 6 |
| Chemistry | – | – | – | 2 | 2 |
| Physics | – | – | 3 | 2 | 5 |
| Technical drawing | – | – | 1 (2) | 1 (2) | 2 (4) |
| Art and writing | 4 | 4 | 2 | 2 | 12 |
| Physical education | 2 | 2 | 2 | 2 | 8 |
| Total | 27 | 28 | 30 | 30 (31) | 115 (116) |
| Optional subjects | | | | | |
| Singing (relatively obligatory) | 2 | 2 | – | – | 4 |
| Singing (optional) | – | – | 2 | 2 | 4 |
| Educational handiwork | 2 | 2 | 2 | 2 | 8 |
| Housekeeping (needlework) | 2 | 2 | 2 | 2 | 8 |
| Shorthand | – | – | – | 2 | 2 |

** Učebné osnovy středních škol a učitelských ústavů. Edited by R. Neuhőfer. Prague 1934.*

## Tuition plans of Czechoslovak schools

After the World War II and liberation in 1945, tuition plans and syllabi were adapted to general schools by the Presidency of the Slovak National Council. In 1945 the first step towards unified education on the second level of primary schools by substantial convergence of tuition contents of burgher schools and lower grades of Gymnasia. Fundamental changes in tuition plan and syllabi concepts under the principles of the socialist school policy (Tab. 3) came along with new school laws of 1948, 1953, 1961 (Pedagogická encyklopédia, 1984 – 1985).

***Table 3***

*1948 general school tuition plans*

| **Subject** | *Level 1. primary school** | | | | | *Level 2. secondary school** | | | | *Level 3. Gymnasium*** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***Class and number of lessons*** | | | | | | | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** |
| Slovak | 9 | 9 | 8 | 8 | 8 | 6 | 5 | 5 | 5 | 4 | 4 | 4 | 3 |
| Russian | – | – | – | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| Other foreign language | – | – | – | – | – | – | – | – | – | 3 | 3 | 3 | 2 |
| Basic knowledge | 4 | 4 | – | – | – | – | – | – | – | – | – | – | – |
| National history and geography | – | – | 4 | 4 | 4 | – | – | – | – | – | – | – | – |
| Philosophy | – | – | – | – | – | – | – | – | – | – | – | 2 | 2 |
| History | – | – | – | – | – | – | 2 | 3 | 2 | 2 | 2 | 2 | 2 |
| Geography | – | – | – | – | – | 3 | 2 | – | 2 | 2 | 2 | – | 2 |
| Natural science | – | – | – | – | – | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Chemistry | – | – | – | – | – | – | – | 2 | 2 | – | 2 | 2 | 2 |
| Physics | – | – | – | – | – | – | 2 | 2 | 2 | – | – | 3 | 4 |
| Arithmetic | 3 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | – | – | – | – |
| Mathematics | – | – | – | – | – | – | – | – | – | 4 | 3 | 3 | 3 |
| Writing | – | – | 1 | 1 | 1 | – | – | – | – | – | – | – | – |
| Drawing | – | – | 2 | 2 | 2 | 2 | 2 | 2 | 2 | – | – | – | – |
| Handiwork/needlework | – | – | 1 | 2 | 2 | – | – | – | – | – | – | – | – |
| Technical drawing | – | – | – | – | – | – | – | 1 | 1 | – | – | – | – |
| Housekeeping | – | – | – | – | – | 0 (2) | 0 (2) | 0 (2) | 0 (2) | – | – | – | – |
| Religion | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | – | – | – | – |
| Civics | – | – | – | – | – | 1 | 1 | 2 | 2 | 2 | 2 | – | – |
| Arts | – | – | – | – | – | – | – | – | – | – | – | 2 | 2 |
| Music | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | – | – |
| Physical education | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Total | 21 | 22 | 25 | 28 | 28 | 28 (30) | 29 (31) | 31 (33) | 31 (33) | 26 | 27 | 28 | 28 |
| Optional subjects | | | | | | | | | | | | | |
| a) Latin | – | – | – | – | – | – | – | – | – | 4 | 3 | 2 | 2 |
| b) Descriptive geometry | – | – | – | – | – | – | – | – | – | 4 | 3 | 2 | 2 |
| Total | | | | | | | | | | 30 | 30 | 30 | 30 |
| Optional education: Hobby groups and workshops | – | – | 2 | 2 | 2 | 4 | 4 | 6 | 6 | – | – | – | – |
| Optional subjects | religion, Latin, descriptive geometry | | | | | | | | | | | | |

** Annex to Školské zvesti, vol. 4, 1948, number 16and 17.*

*** Annex to Školské zvesti, vol. 4, 1948, number 20.*

The physical education curriculum from 1948 was focused on the Soviet system of "fizkuľtura". School reform in 1948 established a nine-year compulsory education and this had been reduced in 1953 to eight years and in 1960, it has extended to nine years. The principle of a uniform school lasted until 1990; it is a school with a minimum of facultative subjects, with the tuition plans centrally managed by the state. The curriculum featured a two-hour subsidy for teaching physical education. It ranged from 6.4 % in the third and fourth year level 2 of the secondary schools to 9.5 % in the first year of the level 1 in the primary schools and represents a percentage of hours taught in a weak in different grades of the tuition plan.

Under the long-term programme document of 1976, "Further Development of the Czechoslovak System of Education", demanding educational requirements complying with the needs of the current socialist society building were imposed on the Czechoslovak education system restructuring. Changes in tuition plans at all levels of general schools (implemented within the basic education content restructuring in 1976 – 1984) organically related to new tuition plans and syllabi of all secondary and higher education institutions (Tab. 4).

***Table 4***

*1976 Gymnasium tuition plan**

| **SUBJECT** | **Class and number of lessons** | | | | **TOTAL** |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | |
| Native language and literature | 3 | 3 | 3 | 3 | 12 |
| Russian | 3 | 3 | 3 | 3 | 12 |
| Other foreign language | 3 | 3 | 3 | 3 | 12 |
| Civics | – | – | 2 | 2 | 4 |
| History | 2 | 2 | 2 | – | 6 |
| Geography | 2 | 2 | – | – | 4 |
| Mathematics | 4 | 5 | 4 | 4 | 17 |
| Physics | 3 | 3 | 3 | 3 | 12 |
| Chemistry | 3 | 3 | 3 | – | 9 |
| Biology | 3 | 3 | 3 | – | 9 |
| Basic cybernetics | – | – | – | 2 | 2 |
| Physical and sports education | 2 | 2 | 2 | 2 | 8 |
| Civil defence education | 1 | 1 | – | – | 2 |
| Basis of production and professional training | 2 | 2 | 4 | 6 | 14 |
| Optional subject | – | – | – | 3 | 3 |
| TOTAL | 31 | 32 | 32 | 31 | 126 |
| Optional subjects | 2 | 2 | 2 | 2 | 8 |

** Ďalší rozvoj československej výchovno-vzdelávacej sústavy. ["The Further Development of the Czechoslovak System of Education and Training"]. Partial projects. Bratislava 1977.*

There were two hours per week for teaching physical education in secondary school tuition plan from the year 1976. It represents 6.3 % (in the second and the third year of study) and 6.4 % /in the first and the fourth year of study in secondary school/ of the overall weakly teaching time.

Tuition plans were provided for the whole Czechoslovak Socialist Republic by the Research Institute of Pedagogy in Bratislava, Research Institute of Pedagogy in Prague, Research Institute of Specialised Education in Prague, university experts and teachers with practical school experience. Certain syllabi were first verified, adapted based on scientific verification in practice, and only then applied.

Until 1989, the Slovak school system was governed by the obligatory ideological uniformity of the whole system of primary, secondary and higher education institutions.

Tuition plans, syllabi and education contents were created for a typical average pupil of the majority society of the Slovak Republic (Cabanová, 2006). A tuition plan is a chart, listing subjects taught at the certain level of school with numbers of lessons. This tuition plan must be 100% complied with requirements of the society.

In the tuition plan both (Tab. 5) horizontal (number of lessons of the subject concerned according to individual grades) and vertical relations (number of lessons of individual subjects

***Table 5***

*1996 Gymnasium tuition plan (applicable)*

(http://www.statpedu.sk/buxus/generate_page.php?page_id=393)

| **SUBJECT** | **Class and number of lessons per week** | | | | **TOTAL** |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | |
| Slovak language and literature | 3 | 3 | 3 | 3 | 12 |
| History | 2 | 2 | 2 | - | 9 |
| Sociology | – | – | 1 | 2 | 3 |
| Arts | 2 | – | – | – | 2 |
| Ethics /or religion/ | 1 | 1 | – | – | 2 |
| Foreign language | 6 | 6 | 6 | 6 | 24 |
| Mathematics | 4 | 4 | 3 | 3 | 14 |
| Informatics | 2 | – | – | – | 2 |
| Physics | 3 | 3 | 2 | 2 | 10 |
| Chemistry | 3 | 2 | 2 | – | 7 |
| Biology | – | 3 | 3 | 2 | 8 |
| Geography | 2 | 2 | – | 1 | 5 |
| Physical education | 3 | 3 | 3 | 3 | 12 |
| Supplementary lessons | – | 2 | 6 | 8 | 16 |
| TOTAL | 31 | 31 | 31 | 30 | 123 |
| Optional subjects | 4/6 | 4/6 | 4/6 | 4/6 | 16/24 |
| Course “Protection of men and nature” | 5-day outdoor course in the 3rd grade | | | | |

according to grade) are subject of importance. For the first level of primary school education some significant changes occurred in the educational documentation in 1995. The curricula and syllabi from the year 1993 were supplemented with new content. Curriculum approved by the Ministry of Education on the 18th of May 1995 under no. 157/95 – 211 brought some changes mainly for teachers to create their own content in the range of 30 % due to the conditions of schools, pupils' needs and specificities of each region.

The whole content of the tuition plan is focused on optimum development of a pupil in various fields of social life and culture. Three lessons of physical education is considered as a reflection of the importance of physical education for the young body.

Despite three hours of teaching physical education, the ratio of represented the weekly teaching physical education compared to the ratio of older curricula did not improve, they represented 6.4 % and 6.6 % of the total weakly teaching time.

Tuition plan openness and flexibility is ensured by lessons chosen from all optional subjects with additional potential of supplementary lessons.

Tuition plan content is historically conditioned. Each era has brought with its socio-economic context of tuition plan content shaping. A tuition plan contains theoretical and practical subjects, general and technical subjects in order to influence the complex development of pupils.

## Conclusion

The committees of the Ministry of Education determine the tuition plan. It is applied to certain types of schools throughout the territory of the Republic and once approved, it becomes the basis of syllabi and timetable compilation. When comparing the content of the syllabi there is a possibility to change the names of subjects, to add new subjects but also change the percentage composition reflecting the number of lessons per week.

Physical education as a compulsory subject has been permanently placed in the school's curriculum since 1968/69.

When comparing the presented plans, the time planned for teaching physical education was usually 2 hours which represented 6.3 % to 10 % of the time for weekly teaching in the different grades in the different curricula. Up to present, the secondary school curriculum from 1996, three hours for teaching physical education were determined, but these three hours meant only 6.4 % to 6.6 % of hours for weekly pupils´ learning in various grades in the curriculum.

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RESUMÉ

## MIESTO PREDMETU TELESNÁ VÝCHOVA A VÝVOJ KURIKÚL V SLOVENSKÝCH ŠKOLÁCH

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Obsah učebných plánov je historicky podmienený. Každé obdobie bolo charakteristické určitým socio-ekonomickým kontextom, ktorý ovplyvnil jeho tvorbu. Obsahom učebného plánu sú teoretické aj praktické, všeobecne vzdelávajúce aj odborne vzdelávajúce predmety zamerané tak, aby pôsobili na komplexný rozvoj žiakov. Autorka sa v príspevku zaoberá teóriou učebných plánov a výberom niektorých učebných plánov z histórie slovenského školstva, v ktorých figuruje predmet telesná výchova. Poukazuje na hodinovú dotáciu predmetu telesná výchova v jednotlivých historických obdobiach slovenského školstva.

# DEVELOPMENT OF SCHOOL PHYSICAL EDUCATION IN SLOVAKIA AND IN THE USA

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**Summary:** The complexity of the situation, rapid changes and various pedagogic traditions aggravate the elaboration of a system view of current reforms of physical education. In spite of this, the aim of our contribution is to describe the most important events in the history of physical education in Slovakia and in the USA and to explain their influence on the current changes in the curriculum. The purpose of this historical analysis is to present the basic information about the development of physical education and thus enable further comparison of current reforms, which we regard as useful for Slovak education, because the school reform in the USA started approximately two decades earlier than in our country. The methodology that we chose is the historical-comparative analysis by which we describe and compare the historical development of physical education in the selected countries.

**Key words:** physical education, history, educational system, Slovakia, USA, school physical education

## Introduction

Physical education ranks to historically the oldest elements of education. If we wanted to present the whole chronology of the development of physical culture, we would have to start with the beginnings of the development of man, when motion was a social phenomenon conditioned by material conditions, vital for the preparation of man for fight and motional fitness was an evolutional selective impulse. The beginnings of the implementation of physical education into the school environment can be dated back to the era of Humanism and Renaissance, but only in the form of after-school activities. The effort to provide the opportunity for physical exercise at school appears simultaneously with the origin of the demand for universal education, which was promoted by J. A. Comenius. However, various circumstances disallowed the effort to come into real practise, and physical education appears in the curriculum only later.

Physical education and sport is a rather complicated system of mutually interacting components. The aim of this article is to present the most important events which had an influence on the development of school physical education as part of the school system in the above mentioned states in the 19$^{th}$ and 20$^{th}$ centuries.

## Methods

The theoretical and methodological bases of the presented study are based on the discipline, which in English language is called "Comparative Physical Education and Sport". In German literature the same discipline is called „Vergleichende Sportpädagogik“ (Kaulitz, 2001). The discipline itself was first mentioned by Bennett (1970). Lately, the comparisons in the sphere of physical education have been in the centre of attention more and more, especially by authors writing in English and German languages, which can be seen from the number of professional contributions dealing with the methodology of comparative research (Hardman, 2000; Kaulitz, 2001; Kudlorz, 1989; Pühse, Gerber, 2005), but also from rapidly increasing number of comparative studies which are focused on various spheres of physical education and sports. Their rapid expansion is evident from the activities of the international organization The International Society for Comparative Physical Education and Sport (ISCPES). This organization publishes the professional journal Comparative Physical Education (recently renamed as International Sport Studies), which contains eight main sections, into which comparative studies are divided (Editorial, 2004).

- Instructional Theory of Sport (theory of education or didactics of physical education/sports),
- Health Foundations,
- Curriculum Theory of Sport,
- Historical-Philosophical Foundations,
- Physical Education Teacher and Coach Education,
- Psychological-Sociological Foundations,
- Comparative Sport Pedagogy,
- Nature and Function of Sport Pedagogy.

Also Kaulitz (2001) emphasises the importance of international perspective in historical-comparative research, which serves as a basis for the comparison of various spheres of physical education and sports; for example, he presents a study called “The German Contribution to American Physical Education: A Historical Perspective“ (Cazers, Miller, 2000), which became an inspiration for the presented contribution. Unlike Cazers and Miller, who analyzed the history of physical culture in various countries mainly in the 19$^{th}$ century, our contribution will also focus on the influence of American culture on the development of physical education in Europe and Slovakia in the 20$^{th}$ century.

Hagg (1989) determines two dimensions of comparative research:

- Horizontal – comparison of different social environs in a given time.
- Vertical – comparison of different time periods in the view of individual topics.

As can be seen in Picture 1, our contribution deals with the development of the conception of physical education in two different countries (horizontal approach) and in different periods of time (vertical approach). The research method that we have chosen is the qualitative analysis (see Gavora, 2000). This method is also more closely specified by Švaříček and Šeďová (2007) or Vlček and Janík (2010). The authors describe the steps of this method, when individual historical events in the monitored countries are put in order

and then they are compared. When analyzing the monitored countries, it is necessary to understand and take into account cultural, historical, social, language and other differences, which are typical for the monitored countries, and which are dealt with in the following genesis.

## Genesis of the conception of physical education in Slovakia in the cultural historical context

In the Slovak territory, physical education gets into schools as late as the year 1851 on the basis of Bonitz-Exner reform, during which physical education was a voluntary subject (Antala, et al., 2001). Obligatory physical education in Slovakia was legalized in 1868 after the defeat of Austria by Prussia and was called gymnastics. It was taught 2 lessons a week; due to the lack of gymnasiums and other facilities it was taught only in spring and autumn (Trunečková, 1996). At first, gymnastics was legalized in primary schools and lower secondary schools, later in grammar schools (1874) and gymnasiums (1893). Gymnastics was at its highest level at the gymnasium in Revúca, the place of work of the teacher and author of the first Slovak physical education textbook "A Short Instruction for Teaching Gymnastics Primarily for Public Schools", which was in the year 1873 written by I. B. Zoch (Perútka, et al., 1985).

At the beginning, the aims of school gymnastics were modest, because its level was mainly reduced by the lack of good teachers and insufficient material equipment. The original system of teaching physical education was based on the Turner Gymnastics, was in force until the end of the 19th century. It was called formalistic movement and was designed by Adolf Spiess. He stressed the forming of man in the view of their military capacity; emphasis was mainly laid on discipline and submission. He concentrated on floor exercises, disciplinary exercises, and exercises on apparatuses. Pre-war physical education primarily prepared young people for the army needs.

After the First World War, Slovak education developed in a new political, social, and cultural context. A significant milestone was the origin of the independent Czechoslovak Republic in 1918, which had a positive influence on the development of education and pedagogy. An important role in the new state was the unification of the structure of educational system and the creation of common educational scheme. However, the development of school physical education was slowed down by several factors: bad facilities at schools, insufficient qualifications of physical education teachers and the absence of compulsory physical education at vocational schools, technical colleges, and universities (Antala, et al., 2001). This situation was solved with the help of Czech physical education professionals and teachers, who spread the ideas of the Sokol (Falcon) Movement. The physical education movement Sokol originated in Bohemia as early as 1862, headed by the professional Dr. Miroslav Tyrš. The Sokol Movement in this period of time played an important progressive role in the development of physical education, keeping fit and also in building not only a beautiful body but also a soul. The Greek Kalokagathia, which means the harmony of physical and mental maturity, was a top goal. According to the guidelines elaborated by Zoch and Tyrš, the movement also worked on political awareness, but it never supported any political party. It remained markedly national, patriotic, and anti-fascist. The attempts to found the Sokol Movement in Slovakia in the years 1871, 1908, 1911 and 1912 were not successful. The then Hungarian government

did not allow any societies in which Slovak citizens could unite and develop their national consciousness (Perútka, et al., 1980). The situation changed after the already mentioned historic milestone, the origin of the 1st Czechoslovak Republic, when the increase of physical education units began and the 1st organized Sokol unit was founded in Uhorská Skalica and another in Stupava. At the beginning of the year 1919, Sokol in Slovakia had 39 Sokol units, which united into the Sokol Masaryk´s Regional Organization and at the end of the year it was divided into six regional organizations (Kössl, et al., 1986). The central character was the Slovak patriot Vavro Šrobár.

A year after the origin of Czechoslovakia, Czechoslovak State University was founded in Bratislava, and a short time later it was renamed as Comenius University. Upon the model of Prague and Brno, the Lectorate of Physical Education was founded, which exerted much effort to organize the preparation of physical education teachers.

In the year 1922 the so-called Little School Act was adopted, which again determined the goals, organizational principles and structure of education. This was the first time that a curriculum, which was based on Tyrš´s System, came into existence. The System accented the need for overall development, but in fact only gymnastic exercises were taught. This step definitely substituted the Spiess´s System. Apart from the Tyrš´s System, also the ideas of French, Hebert's Gymnastic System, and Gaulhofer´s Neo-Austrian System came to Czechoslovakia (Perútka, et al., 1985). Also the Orol (Eagle) Movement and the Workers´ Physical Education Movement tried to get some influence. In the years 1923 – 1928, the Orol, led by Andrej Hlinka, was the most powerful physical education organization. The Orol associated the members of Christian-social parties. Catholic physical education unions associated in the Orol practised exercises according to the Tyrš´s System and contained activities focused on the training of compulsory floor exercises and exercises on apparatuses. They also practised athletics and games and had a more flexible relation towards sports. In addition to the above organizations, there were also other organizations, e. g. the Young Men's Christian Association – YMCA, the Young Women's Christian Association – YWCA, the Scout Movement – the Union of Scout Boys and Scout Girls of the Czechoslovak Republic, tourists – the Club of Czechoslovak Tourists, and also Workers´ Physical Education Unions (RTJ) were founded (Kössl, et al.,1986).

The formation of the so-called Protectorate of Bohemia and Moravia, and in Slovakia the so called Slovak State also influenced the level of school physical education. A negative effect had a forced departure of Czech professionals and teachers. At secondary schools, physical education was taught 3 hours a week but the aims were conditioned by Nazi education, and so in the year 1939 the Physical Education Institute was founded in Bratislava and started to prepare secondary-school teachers.

Significant changes occurred after the end of the Second World War in the year 1945 when the Research Pedagogical Institute in Prague took responsibility for the creation of curriculum. This period was characterized by the effort to unite the school system, physical education became one of the elements of the comparison with the surrounding world and reached such a level that it had had never before. For the first time, stress was put on the need for the integration of upbringing and education. At the same time, the differentiation between sexes was eliminated, and the foundations for standard school were laid. After the year 1946, physical education became an equal partner to all other subjects, and in the following period the curriculum for individual types of schools was designed (Antala, et al.,

2001). However, an explicit emphasis on the material side of education and packed subject matter caused that the aims were not fulfilled.

In the year 1948, the Act on the Basic Regulation of Unified Educational System was passed, which contained many content and ideological changes in the spirit of the then ideology. This Act incorporated all schools into a unified system and outlined their common goal. This system in our country persisted until the year 1990 (Humajová et al., 2008). In the sphere of physical education, school and spare-time physical education were interconnected, and in the whole country the Tyrš´s Badge of Fitness was introduced according to the Soviet model as an ideological means for moral education of the youth and adults, which contributed to building up people's health, general development of fitness, and prepared citizens for work and defence of their country (Perútka, et al, 1980).

In the year 1954, limits and norms were introduced and thus physical education became an annoying subject, because pupils got bad marks and there existed no upbringing. In the year 1960, the Institute of Physical Education and Sports was founded in Bratislava, and in 1965 its name was changed to the Faculty of Physical Education and Sports of Comenius University. In this period, various scientific and research works were realized, but their theoretical results did not get into practice easily. This could be seen from the technical-educational character of compulsory physical education and insufficient load in the view of motional development of capability (Trunečková, 1992).

In the year 1955, the first countrywide Spartakiad took place, and since then it had become a part of physical education in schools. Because of the preparation for the Spartakiad, the tasks of physical education in schools were not sufficiently fulfilled.

In the year 1970, the first pioneer changes appeared. They referred to the incorporation of selective subject matter according to the conditions in individual school and the incorporation of theoretical knowledge, which should have improved the relation to motional activities. These changes also referred to evaluation and grading, when the relation of pupils towards motion and the level of their theoretical knowledge were also taken into consideration.

With the arrival of the scientific-technical revolution, arose the necessity to accelerate the development and implementation of new needs of the society into the contents of education. In this time, the intensity of teaching contents increased so much that for some pupils the contents of education became inaccessible. At present, this moment is regarded as one of the causes, which for years deeply rooted too much theoretical content in the educational system (Humajová et al., 2008).

The curriculum for physical education from the years 1973 – 1976 turned out to be very demanding, and due to insufficient time allocation also unrealistic and oversized. New scientific knowledge in the sphere of physical culture influenced the concept of the curriculum from the year 1973, to which two methodological handbooks were published, and they were used without greater changes until the year 1991, and with amendments referring to ideological and political bearing of educational work until the year 1995. They were focused on the acquisition and improvement of motional skills and habits, the formation of character qualities and building up health as a prerequisite for optimal physical development (Vladovičová, Novotná, 2007).

The year 1989 was a turning point in Slovakia. The "Velvet Revolution" meant a great change for Czechoslovak citizens and its effects are apparent even at present. The development

of events brought radical changes in the state, political, economic and also school life. The system change, however, brought primarily freedom, the chance and prerequisite for self-realisation. The performance perception of physical education was gradually substituted for individual approach to the performance of pupils, and the basic aim of physical education was an optimum physical development with a view to positive influencing of physical and mental health of children.

Antala, et al., 2001 (page 19) states that after the split of the Czecho-Slovak Federative Republic in the year 1993, a new period for school physical education began. This primarily referred to the administration and organization by state bodies in the independent state. In the same year, the Instructions for the Adjustment of Subject Contents in the 1st – 4th Study Years of Primary Schools and the Curriculum for Optional Subjects were adopted. The Instructions contained an amendment about the change in the number of lessons from the original 2 lessons a week to 3 lessons a week, and an optional subject named "motor training" – 1 lesson a week.

In the year 1995, several departments of physical education received a proposal for the curriculum for the 1st stage of primary schools, which came into force in September of the same year. Due to an insufficient testing of comments in practice, the aims were very wide, put great demands on pupils and teachers and the cognitivization of physical education process was significantly strengthened. (Vladovičová, Novotná, 2007). Misunderstanding and incorrect attitudes of teachers towards individual varieties of evaluation resulted in a very free interpretation of physical education. This curriculum was more modern, but in many respect still traditional.

In 1999, the first educational standards were elaborated, which issued from the subject matter of the topical units of the curriculum. The problems of content and performance standard of physical education for the first stage of primary schools were dealt with by two independent teams. One consisted of the teachers at the former Department of Physical Education of the Pedagogic Faculty of Matej Bel University in Banská Bystrica and the other was from the Department of Physical Education of the Pedagogic Faculty of Comenius University in Bratislava. The performance standard was elaborated in the co-operation of several university teachers, the contents standard together with the standardized knowledge test and attitudinal questionnaire for the 4th study year pupils of primary schools was elaborated by the team from the Department of Physical Education of the Pedagogic Faculty of Comenius University in Bratislava (Vladovičová, Novotná, 2007).

An important impulse for the awaking of reform ideas was, in addition to the admission of Slovakia to the European Union, also the decreasing quality of education and insufficient results,which our pupils achieved in international monitoring. Serious faults appeared in the school system and the suspect that the then school system was not comparable with the requirements of the world standard and the requirements of the job market appeared (Humajová et al., 2008). Also the way of life and the liberalisation of physical education lead to the decrease of fitness, impairment of health and the interest of our young generation in the subject, but also less interest in physical exercises. The new Act on Upbringing and Education from the year 2008, which replaced the Act from the year 1984, tries to improve this situation. The State Educational Programme was issued under the auspices of the State Pedagogic Institute and according to the latest school act it is the highest curricular project of education. Changes in the approaches towards the projection of

physical education embodied in curricular documents are characterized by the emphasis on pupils´ satisfaction and pleasure from motion, fitness is considered as a necessary part of development and retaining health, they appeal the need to create a continual relation towards motional activities, physical education and sports, taking into consideration their individual needs. Health belongs among the key words that emphasize the need for the inclusion of physical education among basic school subjects. Health became a dominant factor in the transformation of education in physical education in Slovakia (Šajbidor, Labudová, 2007).

## Genesis of the concept of teaching physical education in the USA in cultural-historical context

Living conditions in American colonies in the 17th and 18th centuries were severe and education was considered as a matter of the Church, not the State, but this view changed in the course of time. The end of the 18th century was influenced by many changes in the lives of Americans, associated with the winning of independence and the creation of the Constitution. After the end of the War for Independence, the attention rapidly turned to education, which led to the improvement of the quality of education. The Enlightenment Era had an important influence on the changes in educational aims and the emphasis on physical exercises was greater than before. American philanthropists who supported both physical and mental education included Benjamin Franklin, Noah Webster, Thomas Jefferson, Henry Barnard and captain Alden Partridge, who supported the reforms of education including physical education.

The 19th century is considered to be the most important period in the history of the USA. Monroe's doctrine declared the independence of this part of the world on colonizing powers, however, in the territory of the USA the tension between the North and the South was increasing. In the view of education, the first half of the 19th century was in token of the decrease the Church's influence and the increase of the State's powers. The years 1830 – 1860 are by some pedagogic historians considered as the period of the so called "architecture of American education" At the beginning of the 19th century, German gymnastics – the Turner Movement reached the USA (Lumpkin, 2004). Around the first half of the 19th century, the term health got into the centre of attention. This was associated with the spread of the Swedish Gymnastic System, which was brought to the United States by Hartvig Nissen. A significant promoter of physical exercises was Catherine Beecher, the director of the Hartford Seminary for Girls (1824), who designed a system of exercises for women and was a promoter of everyday physical exercises and healthy diet, she criticized for example wearing corsets, etc. (Stillwell, Willgoose, 2006). In this period, physical education also got into attention of many universities.

The beginnings of organization in sport branches date approximately back to the period of the Civil War. The first sport branches were baseball and tennis. Then followed ice-hockey, golf, bowling, swimming, basketball and many the so called minority sports. During this period, also American football was becoming popular. In 1888 the Amateur Athletic Union was founded. It covered the sphere of amateur sports activities.

In the second half of the 19th century, YMCA spread around the whole western world. The most distinguished persons in the YMCA organization were for example Robert J. Roberts, Luther Halsey Gulick and James Huff McCurdy (Clifford, 2001).

The years 1880 – 1890 without no doubt belong to one of the most important decades in the history of American physical education, which have their roots in the criticism of the exaggerated formalism in pedagogy and gradual enforcement of the philosophy of progressivism. In the year 1885, the "Association for the Advancement of Physical Education (now AAHPERD) was founded. One of the first most important projects was the creation of school educational programmes, into which also physical education should have been incorporated. The result of the AAHPERD effort was the implementation of physical education into educational programmes of five states.

In the year 1889, a conference entitled "The Boston Conference on Physical Training" took place in Boston. Its purpose was to solve the contradictions in the concept of physical education, which are described as "The Battle of the Systems" (Siedentop, 2006). Each of the systems had its strong representation in various regions of the USA, and thus no agreement was achieved.

The second half of the 19th century was important for the development of recreation and camping. The first playgrounds were founded in Boston, Chicago and New York. Their purpose was to correct the unhealthy life style in the period of the Industrial Revolution. The efforts to the return to nature were pushed forward. Ernest Thompson Seton (1860 – 1946) founded the organization Woodcraft Indians. It was a backwoodsman's movement whose members wanted to follow the pattern of Indian free life in wild nature without the advantages of civilization (Clifford, 2001).

At the beginning of the 20th century, the system of public education was on both institutional and structural sides quite functional. School were locally administered and financed from public resources and provided the basic education for all children. However, the education was not sufficient; it was still formal and was mainly based on memorizing of factual data. Progressive reformers led by John Dewey tried to improve this situation. He perceived education as an instrument for solving problems which man encounters in practical life (Cazers, Miller, 2000).

Since the beginning of the 20th century, the interest in sports and especially games had been increasing, mainly in the period of economic boom (The Golden Age). In the year 1906, "the Playground Association of America" was founded (Singule, 1991). In the year 1891, NEA recognized physical education as part of curriculum (the end of gymnastically oriented physical education). Physical education subject matter included dance, games, health education, outdoor and recreational activities (The New Physical Education). Physical education began to be perceived in all of its aspects very seriously, particularly after the release of the statistics from the First World War (Massengale, Swanson, 1997). Beside progressive reformers, whose aim was first of all the reform of curriculum and teaching methods, many others tried to solve contemporary problems of American education through an administrative reform. We also have to mention the effort to subordinate pedagogic process to strictly scientific principles. These reformers (e.g. E. L. Thorndike) thought that educational outputs (i.e. educational goals) must be closely specified and measurable or controlled. Between the years 1920 and 1945, variety of testing in physical education in the USA rapidly increased. Basically, there were two groups of tests:

- tests oriented towards physical performance or abilities, which were combined into a common index or common score,

- tests assessing motion skills, and each item was interpreted individually (Kelly, Melograno, 2004).

The lack of financial means during the Second World War caused a decrease in the interest in professional sports, but recreational sports became more and more popular (Shift from spectator to participant). The physical fitness of soldiers in the Second World War was not evaluated positively, and that is why physical education in the post-war years got into the centre of attention (Kelly, Melograno, 2004). Around the year 1950 there were more than 400 hostels and universities in the USA, which offered study of physical education. Also the support of scientific works increased significantly. In spite of all this effort, the physical fitness of soldiers in the Korean War lagged behind expectations. For this reason the Federal Government (President Eisenhower) in the year 1956 founded "the Presidents Council on Physical Fitness", whose aim was to increase performance standards in schools.

In the second half of the 20$^{th}$ century, American educational system, but also the whole American society underwent further development, which was influenced by the so called Post-Sputnik Educational Reform, movement for civil rights, the Vietnam War, etc. These events caused the origin of various philosophies referring to physical education. Kelly, Melograno (2004) present their list: Human Movement Philosophy, Humanistic Philosophies, Play Education, Sport Education, Experiential and Adventure Education, Fitness Renaissance and the Wellness Movement.

The curriculum of physical education was innovated. It included the elements of experiential pedagogy, motor education, and co-operative teaching. The aims of physical education further concentrate on lifelong relation towards physical activities. The curriculum also included activities such as golf, badminton, tennis, etc.

One of the most important steps in the sphere of educational legislation in the seventies was the ninth amendment to the Federal Educational Act "the Title IX of the Education Amendments to the Federal Education Act of 1972", which prohibited gender discrimination in all federally subsidized educational programmes (Lumpkin, 2004). This amendment enabled many opportunities for women, especially in the field of professional sport.

The economic recession in the seventies and eighties led to saving in many school programmes including physical education. It is interesting that the crisis of American (global) economy initiated the criticism of Dewey's pedagogical methods and emphasis was again primarily laid on the managerial reform of the school system, on measurability and verifiability of educational outputs.

During the eighties, lives of the Americans were influenced by many factors including informational explosion, but also conflicts with more or less violent ideologies. The expenses on education go up, while the subsidies from the Federal Government show an opposite tendency. The number of pupils who are interested in the study at universities decreases, which causes competitors fight for the so-called "top" students. The aim of the Government is to increase the quality of teaching, ideas such as "mastery teaching" emerge (Robinson, 1992), some people call for the return to the basics of education, and the work of teachers is often criticized.

In the eighties, the support of remedial exercises increased thanks to the support of the legislation of some states, however, there were no specialized programmes for the education

of teachers in this field. A promising step which should have helped to solve the deteriorating health state of American population was the foundation of the National Association for Sport and Physical Education (NASPE), whose aim was the revision of physical education standards. The final, second version of the standards is mainly oriented towards motor development and the support of motor activities (Vlček, Janík, 2010). American teachers of physical education are now facing an important educational goal to prove that new programmes can become a driving force of an effective change.

## Comparison of the development of physical education in Slovakia and the USA

If we want to compare the historical development of physical education in Slovakia and the USA, it is appropriate to divide the compared period into four stages:

- 19th century,
- period before and during the 1st and 2nd World Wars,
- after-war period,
- end of the 20th and beginning of the 21st century.


## 19th century

Gymnastic concepts designed by Guts Muts, Jahn, Pestalozzi, Ling and others were during the 19th century transformed into physical education. It was mainly the Turner Movement, which influenced the beginnings of European and American physical education. German turner exercises including the elements of Jahn-Spiess system were accepted in

various parts of Europe including Slovakia and also the USA (Kössl et al., 1986). Later, mainly in the USA, other gymnastic systems became popular. In spite of the modernizations of physical education contents during the 20th century, elements of the German Gymnastic System (including apparatuses such as a horse, parallel bars, and others) still remain part of physical education in both countries.

## The period before and during the 1st and 2nd World Wars

At the beginning of the 20th century some changes occurred in the concept of physical education, and gymnastic systems were gradually replaced by sports-recreational concepts, which influenced the approaches towards physical education both in Europe and the USA even today. The English system of sports and games began to spread around the year 1890, however, in our region it was not officially accepted, while in the USA due to an initiative of progressive thinkers the curriculum of physical education was innovated much earlier. In our country it was only after the year 1930 that the fascist program of physical education began to include English sports and games into compulsory physical education and only after the Second World War it began an inseparable part of compulsory physical education.

## After-war period

Different approaches towards physical education in the second half of the 20th century were caused by the influence of various political ideologies. The process of the Sovietization in Central and Eastern Europe began to change the concept of physical education at the beginning of the fifties. In school physical education, the emphasis was laid on training methods and showing the success of a school through sport results of pupils. The basis for grading pupils was norms and limits of an achieved sport performance. In the USA in the 20th century, the question how to increase insufficient physical fitness repeatedly appeared and it was always connected with war conflicts. In the second half of the century, the USA accepted a more open approach towards physical education when the emotional side of human psyche, self-assertion, co-operation, motor responsibility, etc. were emphasized.

## The end of the 20th and the beginning of the 21st century

In the nineties, the USA again became the initiator and originator of physical education development, because popular terms such as “fun“, “outdoor“ sports, “jogging“, “aerobics“, “body building“ and others came into Europe. The aims of physical education began to be more oriented towards the pleasure from motion, stimulation of the development of motional abilities, acquisition of skills in sports and formation of positive attitudes towards physical education and sport.

At present, the original number of physical education lessons in Slovakia was reduced to 2 lessons a week. The number of pupils who have an exemption from physical education is increasing, the demand for interest physical education groups is decreasing, and this weakens the fulfilment and mission of physical education. These are problem phenomena which are solved by both countries.

If we consider the four main ways of the development of physical education (sporting, motional, physical and health), which were suggested by Naul (2003), and compare the conception of the both countries concerned, we can say that the conception of physical

education in both countries is oriented towards motor development, while the USA conception lays a greater emphasis on the development of lifelong motional activities and Slovakia concentrates on the development and keeping pupils in good health.

The development of physical education at the turn of the century was characterized by Frömel (2001) as a critical and transformational period, and in his opinion the seriousness of the situation in physical education and sport at present is not changing. So the orientation of physical education depends upon us.

## Conclusion

In spite of globalization, understanding the contexts, principles and practice of national concepts of school physical education, it seems that in the pedagogic community there is no agreement on the understanding of the importance, functions and contents of school physical education (Naul, 2003). In designing the concept of physical education, cultural specifity plays an important role. According to many professional reports about the situation and future of physical education (Hardman, 2003; Hardman, Marshall, 2000, and others), it is not difficult to judge that our teachers will face one of the most difficult periods in history. It is unquestionable that knowing the periods during which physical education developed in other countries, and where it should head, will help us to understand the situation in our country. Educational reforms in the USA have been in progress for a longer time than in Slovakia and we can get valuable information, which can help us in the reform of our school system including physical education. Another comparative study of current reforms in physical education could be a valuable source of inspiring information for the Slovak school system.

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## RESUME

## VÝVOJ ŠKOLSKEJ TELESNEJ VÝCHOVY NA SLOVENSKU A V USA

***Martina Jurkechová – Petr Vlček – Pavol Bartík***

Komplexnosť situácie, rýchle zmeny a rôzne pedagogické tradície sťažujú vypracovanie systémového pohľadu na súčasné reformy telesnej výchovy. Navzdory tomu je cieľom príspevku popísať najdôležitejšie udalosti v histórii telesnej výchovy na Slovensku a v Spojených štátoch amerických a objasniť ich vplyv na súčasné zmeny kurikula. Účelom predloženej historickej analýzy je prezentovať základné informácie o vývoji telesnej výchovy a umožniť tak ďalšie porovnanie súčasných reforiem, čo považujeme za prínosné pre slovenské školstvo, pretože školská reforma v Spojených štátoch bola začatá približne o dve dekády skôr než u nás. Zvolenou metodikou je historicko-porovnávacia analýza, pomocou ktorej popisujeme a porovnávame historický vývoj telesnej výchovy vo vybraných krajinách.

# COORDINATION ABILITIES AND PLAY RELATION SKILLS YOUNG FOOTBALL PLAYERS

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**Summary:** The purpose of this study was to deal with the coordination abilities and game skills of young football players. The aim of this study was to determine the dependence of game skills with regard to coordination abilities of younger pupils of MSK Namestovo and 1st FC Brno. We created a test batteries and controlling exercises to find out the currant state of coordination abilities and game skills. Based on results and with the help of our model we identified the dependence of game skills on coordination abilities in both teams. This dependence was statistically significant. The greater dependence was mainly in the tests focused generally. It was confirmed that there is a very close relationship between general coordination Harre test and "Leading the ball in slalom" test and the control exercise.

**Key words**: football, coordination abilities, game skills, test, controlling exercise, statistical significance

## Theoretical analysis of the problem

Game skills and coordination abilities are often considered to be the same, but it is not the right opinion. Simply, we can say that coordination is genetic trait of nervous system and it facilitates to practice special game abilities. The skill is characterized as an aptitude obtained by learning to solve certain task in a correct, fast and effective way. (Fajfer, 1990).

In specific form coordination abilities are important condition to form and improve the game skills, in which the displays are given by request of exact sport section (Dovalil, 2002).

Skill is characterized as an aptitude obtained by learning or reaction time to handle with certain task in a correct, fast and effective way (Linhart, 1981). Harre (1994) understands the game skills as higher quality of movement skills, which are expressed as a number of specific traits. Dobrý (1982) divides the game skills into:

1. Sensomotoric – perception, differentiation of stimuli, movement control based on checking
2. Intellectual – they are based on theoretical knowledge and practical experiences
3. Social-interacting – they are seen as a result of reciprocal collaboration in teams

The technique of movement is the way to solve certain movement task based on general anatomical and physiological determinants of a man for movement activity and

respecting mechanical regularity of the movement. This is a way of dealing with physical task by an individual player who performs certain model (Leško, 1995).

Sport technique is rational and effective way of finding solution in movement activity in agreement with rules and regularities of biomechanics. Individual sport technique is called sports style (Kasa, 2001).

In sport games the technique is one of the player's qualities and it is known as a way of execution of game activity with respect to conditions of game situation (Dobrý, 1972).

The importance of technique in certain types of sport performance is not the same. In football the priority is the technique. The best interpretation on the dependence of technique on other factors of preparedness of a player is by Choutka (1991; Fig. 1)

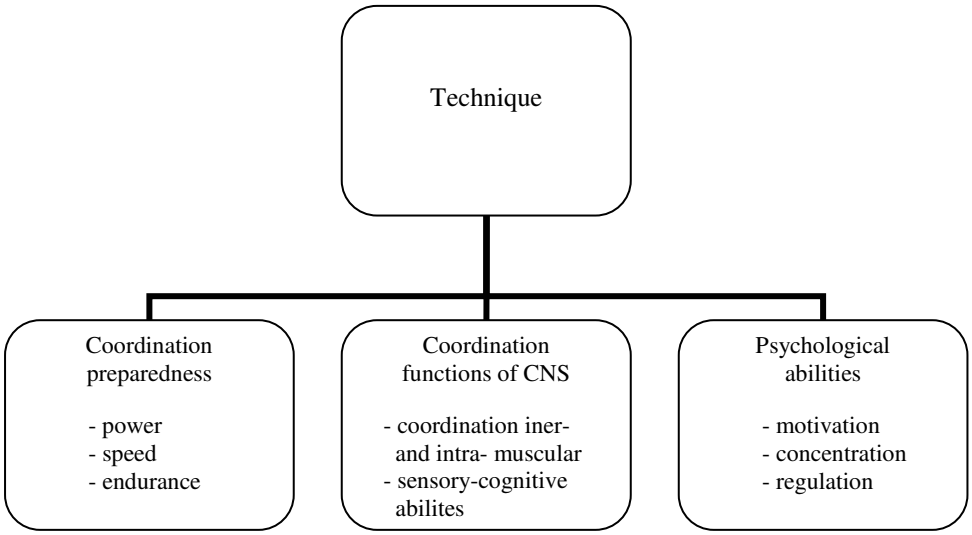


***Figure 1***

*Dependence of technique on other factors of preparedness of a player (Choutka, 1991)*

More authors (Schnabel, 1974; Blume, 1978; Dobrý, 1980; Raczek, 1990; Kasa, 1991; Diaczuk, 1994 and other) agree that there is close relationship between coordination abilities and movement skills (technique), but they should be differentiated.

Měkota (1982) considers abilities as a "more general, partially genetically determined internal predispositions of successful movement activity" and on the other side "skills are represented by dispositions obtained by learning and exercising, based on his own abilities."

Movement skills function in sport is important and mainly in terms of those activities which are conditioned by coordination abilities. Also it is not effective when some activities are done automatically, because it is the question of constant change, adaptability and complexity in them. As a result of this fact, movement skills are necessary for creative activities e.g. activities of players in sport games. Skills in sport games help us to adapt to adequately new and changed conditions (change of the playing surface, weight of ball, etc.).

Abilities express what motor performance can a man reach, how fast can be the motor activity adopted and its development. Abilities operate and show up in close connection with the experience that was acquired in the field of performance – through skills.

Learning and improving sports techniques is related to the problem of sports skills. Skills mean: "promptness to handle with certain task which is obtained by learning correctly, quickly and economically e.g. effectively manage certain activity" (Choutka, Dovalil, 1991). If we take into consideration that the abilities are seen through skills in motoric performance then the principle is that abilities can be best developed according to habits and skills in which the abilities are realized.

Raczek (1990) confirms well-known fact that "the level of coordination abilities conditions the ability to learn new movement skills". Probands with higher level of coordination abilities adopted the new movement activities faster and with higher quality.

## Objectives

The aim of this study is to find out the dependency of game skills from coordination abilities in young football players, younger students MŠK Námestovo and 1st FC Brno.

## Tasks

- Create battery of tests and controlling exercise to evaluate actual condition of the co-ordination abilities and game skills
- Realize measurement to find out actual condition of coordination abilities and game skills
- Evaluate dynamics of the changes in coordination abilities and game skills between monitored teams
- Determine dependence of game skills to coordination abilities using proposed evaluation model

## Methods

In our research we monitored two teams of younger pupils – MŠK Námestovo (1st league – younger pupils of Slovakia) and team of younger pupils 1st FC Brno (1st league – younger pupils of Czech Republic), according to trainers´ recommendation we have chosen 18 players. These players were assessed using test battery prepared by Mokošák (2010). It was composed of six tests to find out an actual condition of coordination abilities and other five tests and control exercise to detect an actual condition of game skills. Players´ average age of MŠK Námestovo was at the beginning of our research at mean decimal age of 11.519 years and they had 4.3 mean player's praxis. Players of 1st FC Brno were at the beginning of our research at mean decimal age of 10.698 years and they had 4.3 mean player's praxis.

For evaluation of actual condition of coordination abilities these tests were used:

- *Walk backwards and forwards on twisted benches (K1)*
- *Stop of tumbling ball (K2)*
- *Long jump with legs together on accuracy (75 % of maximum) (K3)*

- *Run to numbered stations (K4)*
- *Jumping through skipping rope – maintain the same speed of movement (K5)*
- *Harre test (K6)*

To find out the actual condition of game skills we used these tests:

- *Juggling with right and left leg (T1)*
- *Juggling with head (T2)*
- *Leading the ball in slalom (T3)*
- *Pass on accuracy after leading the ball (T4)*
- *Control exercise 1: Special technical efficiency (T5)*

## Results and discussion

***Evaluation of dynamics of the changes of coordination abilities between monitored teams.***

This part contains an overview of statistical parameters, by means of which we compare level of coordination abilities in MŠK Námestovo (N) and 1. FC Brno (B) teams, tab. 1.

***Table 1***

*Statistical evaluation of dynamics in changes of coordination abilities between teams in given tests (N – Námestovo, B – Brno)*

| | Walk ackwards and forwards on twisted benches (s) | | Stop of tumbling ball (cm) | | Long jump with legs together on accuracy (75% of max) (cm) | | Run to numbered stations (s) | | Jumping through skipping rope (s) | | Harre test (s) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N – B | | N – B | | N – B | | N – B | | N – B | | N – B | |
| $\overline{x}$ | 10.11 | 10.11 | 123.39 | 139.72 | 5.61 | 5.33 | 9.38 | 8.57 | 2.37 | 1.50 | 21.59 | 21.40 |
| Dispersal | Equal | | Equal | | Equal | | Equal | | Different | | Equal | |
| T-test | -0.050 | | -2.735 | | 0.184 | | 2.386 | | 1.322 | | 0.411 | |
| P | 0.996 | | 0.010 | | 0.855 | | 0.023 | | 0.197 | | 0.684 | |
| | | | $p < 0.05$ | | | | $p < 0.05$ | | | | | |

Based on results we can say that players from Brno reached in majority of tests better mean performances than the players from Námestovo (besides the test „Stop of tumbling ball“). From the statistical point of view we talk about equal teams since both were statistically dominant in one test ($p < 0.05$; Tab. 1).

***Evaluation of dynamics in changes of game skills between teams***

Based on comparison of both teams we can say that players from Brno reached slightly better performances. Differences between teams were not statistically significant (Tab. 2).

***Table 2***

*Statistical evaluation of dynamics in changes of game skills between teams in given tests (N – Námestovo, B – Brno)*

| | Juggling with R and L leg(n) | | Juggling with head(n) | | Leading the ball in slalom (s) | | Pass on accuracy after leading the ball (n) | | Special technical efficiency (points) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N – B | | N – B | | N – B | | N – B | | N – B | |
| $\overline{x}$ | 19.11 | 20.89 | 8.56 | 11.83 | 21.57 | 20.42 | 6.11 | 6.44 | 11.76 | 11.08 |
| Dispersal | Equal | | Different | | Equal | | Equal | | Equal | |
| T-test | -0.480 | | -1.404 | | 1.959 | | -0.717 | | 1.161 | |
| P | 0.634 | | 0.174 | | 0.058 | | 0.479 | | 0.254 | |

***Evaluation in dependence of game skills and coordination abilities***

To evaluate the dependence between game skills and coordination abilities Person's correlation coefficient was used. Table 3 presents relationships between game skills and coordination abilities, where we connected results of tests MŠK Námestovo and 1st FC Brno into one set (n = 36). Expected close relationship between coordination abilities (Harre test correlates with the other correlating tests) and game skills (the controlling exercise correlates with majority of the other tests to identify an actual condition of game skills) was confirmed. Very narrow correlations ($p < 0.01$) between general coordination test (Harre test) and tests of game skills (Leading the ball in slalom and control exercise) were confirmed too.

***Table 3***

*Dependence of game skills and coordination abilities in players of 1st FC Brno and MŠK Námestovo*

| | T1 | T2 | T3 | T4 | T5 | K1 | K2 | K3 | K4 | K5 | K6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | 1 | | | | | | | | | | |
| T2 | 0.327 | 1 | | | | | | | | | |
| T3 | -0.247 | ***-0.508**** | 1 | | | | | | | | |
| T4 | 0.148 | 0.340 | -0.203 | 1 | | | | | | | |
| T5 | -0.160 | ***-0.588**** | ***0.593**** | -0.367 | 1 | | | | | | |
| K1 | 0.137 | -0.189 | 0.161 | 0.080 | 0.160 | 1 | | | | | |
| K2 | -0.149 | -0.181 | 0.199 | -0.030 | 0.102 | -0.028 | 1 | | | | |
| K3 | -0.049 | 0.180 | 0.104 | 0.158 | ***0.471**** | 0.372 | 0.184 | 1 | | | |
| K4 | -0.030 | -0.233 | ***0.519**** | 0.022 | 0.334 | 0.196 | 0.063 | 0.346 | 1 | | |
| K5 | 0.008 | -0.330 | ***0.517**** | -0.111 | 0.400 | 0.411 | 0.007 | 0.101 | 0.264 | 1 | |
| K6 | -0.002 | -0.332 | ***0.580**** | -0.138 | ***0.676**** | ***0.433**** | 0.293 | ***0.43*5*** | ***0.486**** | ***0.435**** | 1 |
| $p < 0.05$ ; ***p < 0.01**** | | | | | | | | | | | |

***Model of complex evaluation dependence of game skills from coordination abilities***

Model of complex evaluation enables determination of game skills from coordination abilities by means of regression analysis. During the evaluation of dependence we used players´ results MŠK Námestovo and 1st FC Brno reached in tests for identification of game skills and coordination abilities level. To formulate the dependence of game skills from coordination abilities in that extensive test battery (in different mensural units in which these tests were evaluated) used in our research is relatively complicated. Therefore we used a method, based on which we assigned to each performance point value from 0 to 100. We used the theory of normal division in 95 % of covering the set (that means – 2.5 % of the weakest performances we gave 0 points and opposite to 2.5 % of the best performances we gave 100 points). To realize such a model we had to determine upper and lower level to gain the possibility of giving points to measured values.

Normal division in 95 % of covering the set (constant = 1.96)

Determination of upper level = $\bar{x}$ **+ n*s *k**

Determination of lower level = $\bar{x}$ **– n*s *k**

$\bar{x}$ is mean value of performances in whole set in one test

**n** is constant expressing 95 % of covering the set (based on tables of density of normal division)

**s** is standard deviation

**k** is constant: **1** if more points mean better performance

**-1** if less points mean better performance

Giving the points was made based on subsequent formula:

$$\textbf{Points} = \frac{\textbf{score perfomanc – lower level}}{\textbf{width of interval}} \textbf{ *100}$$

**Width of interval =** (upper level – lower level)

**100 points** – proband reached the upper level and more

**0 points** – proband reached the lower level and less

In this way all probands were given point evaluation in every test. Afterwards we counted reached points in tests and control exercise to evaluate the level of the game skills. We did the same way in coordination abilities. For calculation of correlation between game skills and coordination abilities we used these point evaluations too. To get these points we calculate the correlation coefficient based on this fact and then we can assume linear regression of game skills from coordination abilities. With help of "Regression analysis" **(y = a* x + b)** we can evaluate to what level according to the game skills it will depend on coordination abilities.

y = game skills (GS), a = gradient of dependence (slope), x = coordination abilities (CA), b = point of intersection – axis with y (intercept – how is the condition of game skills if the coordination abilities were 0).

In our proposed model of evaluation of dependence in game skills from coordination abilities in both research teams there was a statistically significant difference – 5 % level of statistical significance (Fig. 2).

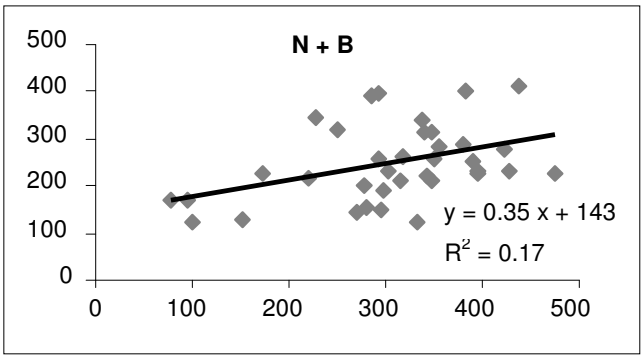


***Figure 2***

*Dependence of game skills from coordination abilities in research sets*

We can say that the dependence of game skills from coordination abilities in our set is statistically significant. In our proposed model for the evaluation of this dependence is shown for 5% level of statistical significance (Tab. 4).

***Table 4***

*Dependence of game skills from coordination abilities in research sets*

| | Dt1 – N + B |
|---|---|
| Rk | 0.41 |
| P | P < 0.05 |
| slope | 0.35 |
| intercept | 143 |
| HZ | 0.35*KS + 143 |
| *Rk – coefficient of correlation. P – level of significance, slope – gradient of dependence, intercept – displacement in the y-axis. GS – game skills* | |

Based on measured results in our selected test batteries, we folloved the relationship between game skills and coordination abilities. Positive relationship of game skills and coordination abilities are shown in several measurements. From our point of view, the most interesting dependences between general test of coordination abilities (Harre test) and tests of game skills "Leading the ball in slalom" and also control exercise "Special technical efficiency" appeared.

Harre test correlated closely with most other tests aimed at detecting the level of coordination abilities. According to this fact it opens the question whether it would be better for detecting the level of coordination abilities to use just such general tests. We tend to Měkota´s opinion (1982), that the coordination ability of the compound movement, which is manifested mainly in the more complex physical activities and therefore it does not have to be negative , if one test affects various coordination skills.

It was very similar in the game skills where the test "Leading the ball in slalom" and control exercise "special technical efficiency" correlated closely with other tests of game skills. In this way we recommend to detect the state of game skills to use tests, or control exercises, which are by their nature close to the player's actions occurring within the game itself.

## Conclusion

It follows that in the future to recognize the level of the game skills and coordination abilities general education tests may be recommended. This fact has several positives. Narrowing of the test battery to one or two general tests to find out the level of coordination abilities and one or two tests (control exercise) to determine the level of game skills, the diagnostic would be simplified and accelerated as well as research organization. Mikuš, Lafko, Mihalčin (2004) see the advantages in the usage of complex tests to detect the level of coordination abilities. Particularly in not increasing the time devoted to the coach to control and diagnostic activity. When choosing general coordination tests, however, we must be careful about the appropriateness of their choice in terms of fitness performance.

In our paper we have confirmed that the dependence of game skills from coordination abilities is statistically significant. This statistic significance was demonstrated mainly in tests with general design. It confirms a very close relationship with the general coordination Harre test and the test "Leading the ball in slalom" and control exercise. Considering those facts recommendation for the future is to assess the level of game skills and coordination abilities mainly through such tests.

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## RESUMÉ

## VZŤAH KOORDINAČNÝCH SCHOPNOSTÍ A HERNÝCH ZRUČNOSTÍ MLADÝCH FUTBALISTOV

***Martin Mokošák – Miroslav Holienka***

V príspevku sa rieši problematika koordinačných schopností a herných zručností mladých futbalistov. Snahou bolo určiť závislosť herných zručností od koordinačných schopností mladších žiakov MŠK Námestovo a 1. FC Brno. Vytvorili sme testové batérie a kontrolné cvičenia na zistenie aktuálneho stavu koordinačných schopností a herných zručností. Na základe výsledkov sme pomocou nášho modelu určili závislosť herných zručností od koordinačných schopností v sledovaných družstvách, ktorá bola štatisticky významná. Väčšia závislosť sa prejavovala predovšetkým pri všeobecne zameraných testoch. Potvrdil to veľmi tesný vzťah všeobecného koordinačného Harreho testu s testom „Vedenie lopty v slalome“ a s kontrolným cvičením.

# THE EFFECT OF THE HIGHT OF DROP JUMPS ON THE PERFORMANCE OF BUNNY JUMPS

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**Summary:** The aim of this study was to investigate the relationship between mechanical output in maximum vertical and horizontal jumping of the students in their 3rd of study at the Faculty of PE and Sport, University of Tuzla. The sample of students consisted of female (N = 30) and male students (N = 37). Sample of dependent variables contained the Drop Jumps (DJ) 20, 40, 60, 80, 100 cm. A sample of independent variables included only one variable Bunny Jump (BJ). All data was analyzed using Tanita TBF-300A, Optojump, Brower Timing Systems and SPSS 12,0. A statistically significant correlation with students between dependent and independent variables is found, and it is defined by only one DJ 80 cm.

**Key words**: drop Jumps, bunny jumps, optojump, explosive power of lower limbs

## Introduction

Arms and legs muscle strength in general, and vertical jump performance in particular, are considered as critical elements for successful athletic jumps and bunny jumps performance. In scientific literature the results testing human muscle strength they are usually reported either in absolute (watts; W) or in per-body mass ratio standards (W/Kg) values. Activity of the muscles can be presented in three main ways: concentric contraction (C), eccentric (E) and isometric (I), where the distance is constant, only changes muscle tone Hay and Reid (1982).

The importance of gymnastic elements in Bunny jumps forward (picture 1) is that this jump which is performed on the ground in its structure has five stages (taking off, first flight phase, taking weight on hands, second flight phase, two-feet landing), that is 1/7 (Figure 2) of the element of vaulting in gymnastics (Longyka, 1969, Prassas, 2002, Čuk, Karacsony, 2004). So we can use it as a warm-up and easier way of learning elements of jump in an analytical method which usage is the most common while learning gymnastics elements like these. The first phase is a sprint in the vault. This is an important phase because the following phases are dependent on it Čuk et al., (2007). The jump on the springboard must be completed with minimum loss of sprint speed. Good and fast run-up helps in take off, and the better take off is the better performance of the vault is. Ferkolj, S. M. (2010.). Antonov (1975) and Semenov (1987) measured the distance at the take off on the springboard were between 2,3 – 2,8 m. Flight time is depended on the speed of the running and force at the take off. When analyzing the data used in this work, most of the

gymnasts achieved the time from 0,24 to 0,30 s. Čuk and Karacsony (2004) found that elite gymnasts spent only 0,24 s. to complete the take-off phase on the springboard following the sprint approach. The time of the first flight depends on the relationship between horizontal and vertical velocity Prassas (2002). Analysis of the results in the example by Ferkolj, S. M. (2007) showed that all the components of velocity in (x, y, xyz) axis differ in percentage. Velocity component in x-axis is reduced by 31,33 %, the y-axis increased by 76,09 % while the overall velocity component in xyz axis decreased by 10,60 %. Analyzing this stage of the jump, the authors found out the following usage of the time in jump Semonov (1987) it means that the usage of the time is generally 0,13 to 0,15 s. Čuk, Karácsony (1995) have established 0,08 s for a simple jump type stoop. In his research the author Ferkolj, S.M. (2010) found that at the first hand contact with the table, overall speed was (xyz) is 5,724 $m.s^{-1}$. Atiković (2011) analyzes that the time of the second flight phase for easy jumping types stoop and hecht ranges from 0,70 to 1,20 s heavy jump type Dragulescu piked. Landing is the last, where in a very short time, stopping the gymnast must produce a force to stop the movement and rotation.

Bunny jump forward is one of the most important elements in gymnastics according to vaulting. They require eccentric take off, the head is not seen in the phase of flight. Landing is on both hands. The influence on the development of motor skills is important and that especially relates to the coordination and strength Begatović et al., (2010). It is interesting that in the school curriculum, bunny jumps forward are not represented as a special methodical unit and knowing their influence on performance at the take off, we wonder whether such decision is right. Authors Atiković et al., (2009) in their research confirm that the analysis of all and each individual motor variables with the variables criteria bunny jumps emphasizes statistical signification of variable agility on the ground backward.

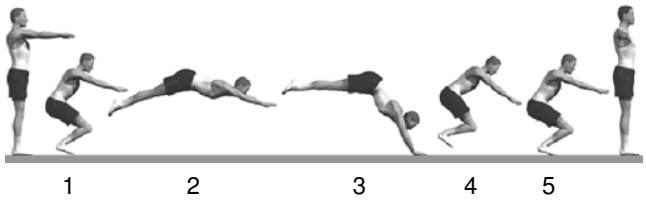


***Figure 1***

*Changes the position in the important bunny jump phases of BJ (1 – 5)*

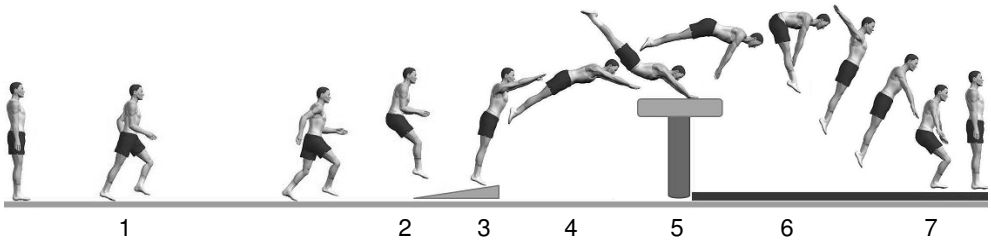


***Figure 2***

*Vault important phases (1 – 7)*

## Methods

### *Subjects*

The sample consisted of female (N = 30) and male students (N = 37) 3rd year of the study at the Faculty of PE and Sport University of Tuzla, who regularly attended classes in Artistic Gymnastics – twice a week for 60 minutes.

### *Anthropometrics and body composition*

Height and body mass were measured before passing all tests on physical fitness abilities. Body height was measured using Martin's anthropometer with precision of 0.1 cm. Harpenden skin fold caliper is used to measure the skin fold thickness and the estimation of total body fat, body type (standard), weight (kg), body mass index (kg/m²), basal metabolic rate (kJ), basal metabolic rate (kcal), impedance (Ω), Fat %, fat mass (kg), fat free mass (kg) total body water (kg), was measured using Tanita TBF-300A Pro Body Composition analyzers scales with precision of 0,1 kg. The components of the body composition based on the reactance and resistance were measured by bioelectrical impedance. Students were barefooted during these measurements.

### *Physical fitness tests*

The EUROFIT test battery was used to measure Physical fitness. This battery consists of several tests to measure the basic motor capacity of the subjects. All tests were performed according to standard conditions. To measure the characteristics of jumps we used the laser system Optojump length of 2 meters. Optojump possesses high values of reliability. Time series are measured in 1/1000 s. Using Optojump we wanted to measure the following variables: total time (mm:ss), specific energy (J/Kg) total energy (J), specific power (W/Kg), time of contact (s), time of flight (s), height (cm), power (W/Kg), frequency (stride/s), number of jumps (freq.).

To measure bunny jumps distance (cm) and speed passage at 3, 6, 9 m we used Brower Timing Systems – Wireless Sprint System. Times were accurate: to 1/100th of a (s). Measured variables of bunny jumps were: time of hand support time (s), legs support time (s), total time flight phase (s). All jumps were recorded with two SVHS cameras and in frequency of 60 frames in seconds. The cameras were put to record important phases. Data book was made in several parts: transfer of video records of movement quantitative data, edit that recorded data into Excell 2007. Data obtained in this study were analyzed using a software system for multivariate and unvaried data analysis SPSS 12,0 (Statistical Package for the Social Sciences) data processing was performed at the Faculty of PE and Sport of Tuzla, University of Tuzla. We used standard statistical procedures to determine the following basic parameters descriptive variables. Applying the analysis of the inter-correlation matrix of variables (Correlations) determines the contents and value of the matrix of correlation coefficients. We will use Kolmogorov-Smirnov test to determine the normality of distribution of the results for further multivariate analysis. By regression analysis we will try to determine whether the DJ is dependent on some drop jumps and what are the types of those jumps.

## Results and Discussion

In (tables 1 – 4) of the final value of anthropometry, body composition and physical fitness tests, bunny jumps with mean values, SD, min., max., results and the percentage difference between male and female students, Kolgmogorov-Smirnov normality of distribution of the test results. Mutual comparative results in the mentioned tables foun the reason for the lower score of female motor abilities and morphologic characteristics all values

***Table 1***

*Descriptive statistics of Anthropometry, Body composition and Physical fitness tests*

| **Variables** | **Female (N = 30)** | | | | **Male (N = 37)** | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Min | Max | Mean | SD | Min | Max |
| Body type (Standard & Athlete) | Standard | | | | Standard | | | |
| Height (mm) | 1640 | 60,827 | 1600 | 1710 | 1817,567 | 61,617 | 1720 | 1980 |
| Weight (kg) | 61,033 | 6,153 | 55 | 67,3 | 80,359 | 9,117 | 69,1 | 113 |
| Age (Year) | 21 | 0 | 21 | 21 | 21,81 | 0,844 | 21 | 24 |
| Body mass index (kg/m²) | 22,666 | 1,04 | 21,5 | 23,5 | 24,329 | 2,484 | 20 | 32 |
| Basal metabolic rate (kJ) | 6050,666 | 291,376 | 5777 | 6357 | 8105,108 | 587,104 | 7305 | 10142 |
| Basal metabolic rate (kcal) | 1446 | 69,346 | 1381 | 1519 | 1937,189 | 140,278 | 1746 | 2424 |
| Impedance (Ω) | 531,666 | 47,437 | 477 | 562 | 485,702 | 50,798 | 372 | 598 |
| Fat % | 25,1 | 4,479 | 21,8 | 30,2 | 16,194 | 3,915 | 8,9 | 25 |
| Fat mass (kg) | 15,5 | 4,3 | 12 | 20,3 | 13,259 | 4,474 | 6,5 | 28,3 |
| Fat free mass (kg) | 45,533 | 2,203 | 43 | 47 | 67,1 | 5,739 | 57 | 84,7 |
| Total body water (kg) | 33,333 | 1,594 | 31,5 | 34,4 | 49,124 | 4,2 | 41,7 | 62 |
| Skinfold – triceps (mm) | 17 | 4 | 13 | 21 | 8,837 | 4,079 | 4 | 22 |
| Skinfold – biceps (mm) | 14 | 7,549 | 7 | 22 | 6,378 | 2,67 | 3 | 17 |
| Skinfold – subskapular (mm) | 17,666 | 5,131 | 12 | 22 | 16,459 | 8,674 | 8 | 54 |
| Skinfold – abdominal (mm) | 27,333 | 3,785 | 23 | 30 | 19,702 | 9,231 | 7 | 40 |
| Skinfold – quadriceps f. (mm) | 29 | 6 | 23 | 35 | 22,243 | 8,712 | 7 | 47 |
| Skinfold – triceps (mm) | 19,666 | 4,509 | 15 | 24 | 12 | 7,568 | 4 | 42 |
| Plate tapping in 20 sec. (freq.) | 43,333 | 4,163 | 40 | 48 | 47,729 | 4,432 | 39 | 57 |
| Leg tapping in 15 sec. (freq.) | 23,333 | 1,527 | 22 | 25 | 22,918 | 1,861 | 19 | 28 |
| Test sit and reach (cm) | 31,666 | 8,504 | 23 | 40 | 32,567 | 6,99 | 12 | 47 |
| Flamingo balance test (freq.) | 9,333 | 1,154 | 8 | 10 | 9,864 | 4,54 | 3 | 22 |
| Shoulder flexibility (cm) | 99,666 | 13,012 | 87 | 113 | 86,27 | 10,918 | 62 | 110 |
| Sit-ups in 60 sec.(freq.) | 35,666 | 8,962 | 30 | 46 | 33,324 | 8,086 | 15 | 48 |
| Lifting a torso from l. p. max rep. (freq.) | 25,333 | 11,718 | 12 | 34 | 25,081 | 7,342 | 14 | 47 |
| Agility on the ground – bac. (sec.) | 12,91 | 1,77 | 11,26 | 14,78 | 10,201 | 1,784 | 6,71 | 14,12 |
| Standing jump – Sargent vertical jump (cm) | 34 | 4,582 | 29 | 38 | 50,567 | 6,304 | 34 | 62 |
| Standing broad jump (cm) | 168 | 7,211 | 160 | 174 | 211,108 | 24,179 | 177 | 272 |
| Bent arm hang (sec.) | 10,07 | 5,837 | 6,65 | 16,81 | 33,996 | 15,092 | 8,89 | 67,24 |
| Medicine ball throwing (3 kg) (cm) | 340 | 10 | 330 | 350 | 566,945 | 61,726 | 430 | 710 |

are usually lower Čuk, Bučar (2000). DJ is of high importance in order to achieve sporting performance in both team and individual sports. In (table 2), all the jumps performed by men reached higher values than female students. The biggest difference is in the drop jump 80 cm and the percentage of that is 25 % in favor of the students, while the smallest difference is the drop jump 20 cm and the percentage is 9 % higher value for the benefit of students. In (table 3), students compared to female students had a greater jump distance of 37 cm, the smaller number of jumps to 9 m, the shorter the time spent during the phase of the rear leg and arms and for 0,047 s the longer duration in the flight phase.

***Table 2***

*Descriptive statistics DJ 20, 40, 60, 80, 100 cm*

| **Variables** | **Female (N = 30)** | | | | **Male (N = 37)** | | | | **F – M** |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Min | Max | Mean | SD | Min | Max | Mean % |
| **Drop jump 100 cm** | | | 1 | | | | 1 | | |
| Total time (mm:ss) | 0,357 | 0,018 | 0,337 | 0,373 | 0,459 | 0,6 | 0,356 | 0,557 | -22,222 |
| Specific energy (J/Kg) | 1,54 | 0,158 | 1,365 | 1,672 | 2,582 | 0,658 | 1,523 | 3,729 | -40,356 |
| Total energy (J) | 94,588 | 18,568 | 75,086 | 112,055 | 206,697 | 52,853 | 109,661 | 294,629 | -54,238 |
| **Drop jump 80 cm** | | | 1 | | | | 1 | | |
| Total time (mm:ss) | 0,351 | 0,019 | 0,338 | 0,374 | 0,469 | 0,06 | 0,265 | 0,559 | -25,159 |
| Specific energy (J/Kg) | 1,489 | 0,167 | 1,373 | 1,681 | 2,693 | 0,649 | 0,844 | 3,756 | -44,708 |
| Total energy (J) | 91,404 | 18,646 | 77,784 | 112,656 | 214,474 | 49,646 | 71,754 | 315,477 | 57,382 |
| **Drop jump 60 cm** | | | 1 | | | | 1 | | |
| Total time (mm:ss) | 0,378 | 0,028 | 0,349 | 0,405 | 0,477 | 0,054 | 0,361 | 0,569 | -20,754 |
| Specific energy (J/Kg) | 1,724 | 0,254 | 1,464 | 1,972 | 2,775 | 0,614 | 1,567 | 3,892 | -37,873 |
| Total energy (J) | 106,173 | 25,789 | 80,529 | 132,106 | 221,384 | 47,897 | 133,159 | 342,924 | -52,041 |
| **Drop jump 40 cm** | | | 1 | | | | 1 | | |
| Total time (mm:ss) | 0,378 | 0,009 | 0,367 | 0,386 | 0,471 | 0,054 | 0,336 | 0,57 | -19,745 |
| Specific energy (J/Kg) | 1,718 | 0,089 | 1,619 | 1,791 | 2,705 | 0,605 | 1,357 | 3,906 | -36,488 |
| Total energy (J) | 104,728 | 10,552 | 98,509 | 116,913 | 215,718 | 48,004 | 124,427 | 344,143 | -51,451 |
| **Drop jump 20 cm** | | | 1 | | | | 1 | | |
| Total time (mm:ss) | 0,418 | 0,04 | 0,392 | 0,465 | 0,463 | 0,051 | 0,344 | 0,557 | -9,719 |
| Specific energy (J/Kg) | 2,116 | 0,418 | 1,847 | 2,599 | 2,61 | 0,578 | 1,423 | 3,729 | -18,927 |
| Total energy (J) | 130,518 | 37,992 | 104,729 | 174,148 | 208,442 | 46,247 | 122,193 | 329,654 | -37,384 |

***Table 3***

*Descriptive statistics BJ*

| Variables | Female (N = 30) | | | | Male (N = 37) | | | | F – M |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Min | Max | Mean | SD | Min | Max | Mean % |
| Bunny jump (distance – cm) | 104,333 | 3,511 | 101 | 108 | 141,432 | 25,182 | 92 | 206 | –26,231 |
| Bunny jumps – 9m (freq.) | 6,333 | 1,154 | 5 | 7 | 4,945 | 0,704 | 4 | 7 | 28,068 |
| Bunny jumps – 3m (sec.) | 0,896 | 0,092 | 0,82 | 1 | 0,788 | 0,235 | 0,59 | 1,9 | 13,705 |
| Bunny jumps – 6m (sec.) | 2,573 | 0,136 | 2,45 | 2,72 | 2,024 | 0,402 | 1,42 | 3,8 | 27,124 |
| Bunny jumps – 9m (sec.) | 3,91 | 0,174 | 3,79 | 4,11 | 3,18 | 0,555 | 2,45 | 5,42 | 22,955 |
| Bunny jumps – hand support time (sec.) | 0,36 | 0,08 | 0,28 | 0,44 | 0,302 | 0,054 | 0,24 | 0,48 | 19,205 |
| Bunny jumps – legs support time (sec.) | 0,453 | 0,1 | 0,36 | 0,56 | 0,365 | 0,098 | 0,24 | 0,6 | 24,109 |
| Bunny jumps – total time flight phase (sec.) | 0,066 | 0,046 | 0,04 | 0,12 | 0,113 | 0,094 | 0,04 | 0,4 | –41,592 |

Reviewing the results (table 4) of the Kolmogorov-Smirnovog test normality of distribution show in all variables that distribution of the results does not deviate from the normal distribution of results, which were brought to fulfillment of the conditions for further multivariate analysis.

***Table 4***

*Kolmogorov-Smirnov Test*

| One-Sample Kolmogorov-Smirnov Test | | | | | | | |
|---|---|---|---|---|---|---|---|
| N = 37 | | DJ100 | DJ80 | DJ60 | DJ40 | DJ20 | BJD |
| Normal Parameters[a.,b] | Mean | ,459 | ,469 | ,477 | ,471 | ,463 | 141,432 |
| | Std. Deviation | ,060 | ,060 | ,054 | ,054 | ,051 | 25,182 |
| Most Extreme Differences | Absolute | ,092 | ,093 | ,091 | ,130 | ,102 | ,120 |
| | Positive | ,083 | ,071 | ,058 | ,091 | ,102 | ,120 |
| | Negative | -,092 | -,093 | -,091 | -,130 | -,086 | -,072 |
| Kolmogorov-Smirnov Z | | ,557 | ,567 | ,551 | ,791 | ,619 | ,731 |
| Asymp. Sig. (2-tailed) | | ,916 | ,905 | ,922 | ,558 | ,838 | ,659 |

a. Test distribution is Normal.
b. Calculated from data.

Examining and analyzing Pearson's matrix of intercorrelation which is applied on measuring of BJ and DJ (table 5), it can be observed that the matrix includes coefficients of correlation which have statistically higher value on the statistically significant level of 0,01. High values can be observed in all inter-correlations of the results. Criterion variable BJ achieved a statistically significant relationship with five variables: DJ 40 cm (,538), DJ 100 cm (,499), DJ 60 cm (,389), DJ 20 cm (,388), and DJ 80 cm (,354).

***Table 5***

*Pearson's matrix of intercorrelation DJ and BJ*

| **Correlations** | | | | | | | |
|---|---|---|---|---|---|---|---|
| N 37 | | BJDIS | DJ100 | DJ80 | DJ60 | DJ40 | DJ20 |
| Pearson Correlation | Bunny Jumps – distance (cm) | 1,000 | ,499 | ,354 | ,389 | ,538 | ,388 |
| | Drop Jump 20 cm | | 1,000 | ,719 | ,776 | ,750 | ,715 |
| | Drop Jump 40 cm | | | 1,000 | ,920 | ,792 | ,797 |
| | Drop Jump 60 cm | | | | 1,000 | ,837 | ,833 |
| | Drop Jump 80 cm | | | | | 1,000 | ,790 |
| | Drop Jump 100 cm | | | | | | 1,000 |

Correlation is significant for all at level $p < .01$; N = 37 male students

Regression analysis of the criterion variable BJ manifested in the area of selected variables (table 6), does not provide enough information about the effects on the appropriateness of the variables on the successful performance of the jump. Common variability is 59 % with the criterion explained by (R Sguare) using prediction system of the variables, while the correlation of the entire system, the predictor variables with the criterion, coefficient of multiple correlation is (RO) 34.

***Table 6***

*The regressive analysis of the criteria variable*

| **Model Summary** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | ,590[a] | ,348 | ,243 | 21,9109799 | ,348 | 3,310 | 5 | 31 | ,016 |
| a. Predictors: (Constant), Drop Jumps 20, 40, 60, 80, 100 cm | | | | | | | | | |

After the insight into the applied univalent analysis of the variance on the sample of 37 male students examinees (table 7) (ANOVA), we ascertained that the value of the univalent test (F-test) is 3,310 so that the contribution of the applied variables is of great significance. However, some important differences between the items were noticed, namely the arithmetic mean and variability. Also, there are significant relations on the statistically important level of the treated variable, Sig. ,016.

***Table 7***

*Univalent analysis of the variance (ANOVA)*

| ANOVA[b] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 7946,259 | 5 | 1589,252 | 3,310 | ,016[a] |
| | Residual | 14882,822 | 31 | 480,091 | | |
| | Total | 22829,081 | 36 | | | |
| a. Predictors: (Constant), Drop Jumps 20, 40, 60, 80, 100 cm | | | | | | |
| b. Dependent Variable: Bunny Jumps – distance (cm) | | | | | | |

Analyzing the impact of individual variables (table 8), one can see that the only statistically significant effect on the criterion variable is a variable: DJ 80 cm Beta (,611) which is significant at the level of $p < 05$. Significant prediction is just within this variable and this means that the increase in the length of the jump phase of flight time is best defined with this variable. It can be established that it would be best to develop the drop jumps during the training phase of the eccentric take off in bunny jump forward. Analyzing the results, no explanation for the phase of flight was found, how long does the movement of the legs last, the marginal values during the phase of flight, body weight and height, swing arms in the direction towards engaging two hands in front and these parameters are not included in 66 % variance. In future work, it would be required to take into account other biomechanical parameters to determine successful performance. Marković (2007) in his research provides training plyometric drop jumps with a statistically significant and

***Table 8***

*The impact of individual variables on the criteria variable*

| Coefficients | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Non standardized Coefficients | | Standardized Coefficients | t | Sig. | 95,0 % Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 28,933 | 35,063 | | ,825 | ,416 | -42,578 | 100,444 |
| | Drop Jump 20 cm | 146,505 | 101,465 | ,350 | 1,444 | ,159 | -60,434 | 353,445 |
| | Drop Jump 40 cm | -49,740 | 155,028 | -,120 | -,321 | ,750 | -365,921 | 266,441 |
| | Drop Jump 60 cm | -115,088 | 207,540 | -,248 | -,555 | ,583 | -538,368 | 308,192 |
| | Drop Jump 80 cm | 282,267 | 132,867 | ,611 | 2,124 | ,042 | 11,284 | 553,250 |
| | Drop Jump 100 cm | -20,613 | 136,200 | -,042 | -,151 | ,881 | -298,395 | 257,168 |
| a. Dependent Variable: Bunny Jumps – distance (cm) | | | | | | | | |

practically relevant improvement in vertical jump height with the mean effect ranging from 4,7 % (SJ and DJ), over 7,5 % (CMJ-fa) to 8,7 % (CMJ) a statistically significant and practically relevant improvement in vertical jump height with the mean effect ranging from 4,7 % (SJ and DJ), over 7,5 % (CMJ-fa) to 8,7 % (CMJ). Kyselovičová, Zemková (2010) study of 5 junior gymnasts compares power in the active phase of take off and height of the jump in maximal and during changed aerobic gymnastics routine. Results showed that subject achieved the highest value in maximal jump (MJ) test, but in combination of high impact aerobics and aerobic jumps (AG II) the examined subjects were able to perform maximal power during the test with only slight decrease about 2 %. A group authors Kollias, et al. (2004) have studied 6 different sports performed DJ from 60 cm on a force board. Results revealed that volleyball players jumped higher ($p < 0,001$) than other athletes because of the fact that they conduct more drop jumps on their practice. However, track and field athletes produced higher peak force and higher power output using a shorter upward phase ($p < 0,001$).

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## RESUMÉ

## VPLYV VÝŠKY ZOSKOKU NA VÝKON SKOKU „BUNNY JUMP“

***Almir Atiković – Jasmin Čejvanović – Edis Begatović***

Cieľom príspevku bolo zistiť vzťah medzi výkonom vertikálneho a horizontálneho skoku u študentov Fakulty telesnej výchovy a športu, Univerzity Tuzla. Výskumný súbor tvorili ženy (n = 30) a muži 9 (n = 37). Závislou premennou bol zoskok (DJ) z výšky 20, 40, 60, 80 a 100 cm. Nezávislú premennú predstavoval skok z nôh na ruky, tzv. „Bunny Jump“ (BJ). Všetky údaje boli spracované pomocou Tanita TBF-300A, Optojump, Brower Timing System a SPSS 12,0. Štatisticky významnú závislosť sme zistili len pri zoskoku 80 cm.

# THE EFFECT OF HORSE RIDING ON STABILOGRAPHIC PARAMETERS IN TEENAGE CHILDREN WITH MILD MENTAL RETARDATION

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**Summary:** The process of balance keeping is characterized by constant changes of parameters. Horse riding is one solution for improving balance. The objective of this paper is to present the results of horse-riding training undertaken in order to analyze the scope of its influence on the balance of children with mild mental retardation. The research covered 54 boys with mild mental retardation, aged 15 – 17 and randomly selected to participate in the research. The boys were divided into two equal groups: the control group and the experimental group, which participated in the horse riding classes for the period of 10 weeks, 3 times a week for 45 minutes. Balance was examined on the balance platform Accu Sway Plus in standing position. The description that was used: average placement of the centre of gravity, average speed of the changes in the placement of the centre of gravity, average radial placement and the length of the path covered by the centre of gravity. The experimental group showed numerous differences before and after the training. The nature of changes in the analyzed positions is the same: the values of body sway in the frontal and sagittal planes and their range as well as the average placement is remarkably, statistically smaller after the training. The same tendency is to be observed in average radial placement. Moreover the placement speed is smaller, as well as the length of the path covered by the centre of gravity on the basal plane. All remarkable changes and revealed tendencies in the experimental group, which appeared as the result of 10 weeks horse riding training influence, indicate the improvement of the balance reactions. The lack of changes in the control group shows that there were no factors that might have caused such effects as those in the experimental group.

**Key words:** balance, platform balance trainer, the center of feet pressure X and Y, range X and Y, avg displacement along X and Y (DISPavgx and DISPavgy), avg. radial displacement (RDavg), length covered by the path of the COG (L), avg velocity (Vavg), mild mental retardation, horse riding

## Introduction

One of the main aims of studying human motor activity is aspiring to increase its effectiveness and control over human movement. Motor skills depend on many individual conditions: motor and physical abilities; representing the potentiality of a person in motor development, and physical and motor fitness; which development is an important element

of psychomotor education. The basis for developing motor efficiency are coordination capabilities, of which – balance is very important [1, 2, 3, 4, 5, 6 ].

The ability of maintaining body balance and regulating it in the standing position is a process demanding a very precise level of neuromuscular coordination [7, 8, 9, 10]. Balance reactions, which occur on different levels of the nervous system, create mechanism to ensure the correct position of the centre of gravity (COG) on the basal plane [11].

An important feature of the mechanism regulating body balance as a cybernetically closed system – is the ability to self-regulate. The entirety of the processes proceeds with the use of feedbacks, by maintaining control over the progression of the motion and making corrections accordingly to the differences between the desired state and the actual state. Studying body balance enables the evaluation of coordination predispositions based on the efficiency of activating motor programs existing in nervous centres [10, 11].

This system functions on feedback – the basis of which is the influx of information from the circuit [7, 8, 13, 14]. The system of regulating body posture requires improving and development. The program, on which it is based, is developed when the child gains motor abilities (during learning and memorizing moves). The repetition of the stimuli leads to the improvement of coordination, which also leads to creating a motor habit.

Mentally retarded children are characteristic of psychomotor depletion adequate to the level of retardation. Depending on the extent and depth of the disorders there are different types of retardation. The International Classification of Diseases (ICD – 10) distinguishes 4 levels of mental retardation; provides their statistical numbers and determines the intelligence quotient limits: F70 – mild mental retardation (II = 50 – 69), F71 – moderate mental retardation (II = 35 – 49), F72 – severe mental retardation (II = 20 – 34), F73 – profound mental retardation (II < 20) [15].

The immediate cause for mental retardation is the injury of the central nervous system, which entails lowering of the intelligence. Mentally retarded children display disorders of: mental process, cognitive orientation process, executive process and the ability of social adjustment. A vast part of those children also suffers from motor development disorders, in strict connection to their mental development [12, 16].

A mildly retarded child learns and acquires different skills, although the pace of mastering the skills is slower, and the final level of results lowers when compared to a person with correct development. The child slowly masters the correct self-service habits, establishing social contacts and respecting social rules and norms in a group. Usually mentally retarded children of the mild level do not differ from their peers in external appearance, but under a closer observation – a lack of harmony in their development and a apparent physical weakness may be noticed [17, 18].

Today, mental retardation is treated in dynamic categories, because a certain development potential has been identified among people affected with this disability [19, 20, 21, 22]. The effective possibility of their improvement was acknowledged in the scope of: motor improvement, mental processes development, character, and hobby development.

Horse – riding enables the regulation of the level of starting and body exertion accordingly also to the mentally handicapped rider's needs. This is due to an appropriate method in teaching classes and selection of exercises. An appropriate dosage of motion and its type is also possible. Through it, hippo therapy becomes one of the therapeutic methods.

Due to its broad spectrum of effect, it normalizes the abnormal muscle tension triggered by the injured central nervous system. It gives the opportunity of training balance constantly, because the forces influencing the rider unbalance him in the frontal and sagittal plane and force him to constantly regain the balance. That is why the stimulation with the use of a horse creates the conditions to master new abilities, which otherwise would not appear or would be greatly delayed.

We can recognize every position, every motion, every change in body position, during horse riding as balance exercises. The basic balance exercise is maintaining the correct mount position during horse walk. Every change in different body part placement changes the centre of gravity of the rider, and transfers new stimuli from the touch receptors and the vestibular system, forcing the central nervous system to registering the stimuli and finding the lost balance [22, 23, 24, 25]. Rider sitting astride on the horse experiences an easy repeatable movement of the pelvis, similar to the pelvis movement noticeable during a healthy man's walk [20, 21].

The balancing of the spine takes place on the moving pelvis. Beside the change of pace, direction and body position fixed in rhythmical motion, horse riding stimulates the sense of balance. In terms of the number of paces a minute, the horse's pace resembles that of a human. An average, adult man makes about 110 – 120 steps per minute, in comparison a large horse makes 100 – 120 steps per minute. During just thirty minutes of training, the rider can repeatedly practise certain abilities, including balance skills, or maintaining a correct upright posture [20, 21, 25].

Body perception, the sum of position receptors and joint motion, muscular tension and balance is extremely important in horse riding. Sense of rhythm is necessary, as it improves balance. A sitting horse's torso automatically acts as a stabilizer and at the same time it uses the natural reflexes responsible for body posture and balance [20, 21, 24, 26].

Thanks to its specific nature, horse riding affects fully the human body. Horse riding, and classes with the use of a horse are a complex holistic form of training, which remains natural in all the necessary moves. Holistic training of the body, considered as comprehensive and universal, leads to the improvement of the standard of life by: increasing the sense of safety (the possibility of avoiding danger due to better physical fitness, or motor abilities), gaining self-confidence (better body posture, springy way of moving), a relative improvement in health and agility defects, increasing life resourcefulness. It thoroughly affects the human body, and fosters individual development [27]. The aim of this study was to evaluate the influence of horse riding on mildly mentally retarded children, considering the chosen stabilographic parameters in casual standing position with eyes closed and open, and in the closed posture with a limited basal plane.

## Study material and methods

The study covered 54 mildly mentally retarded students from the Education Centre in Leżajsk. All of them were boys between 15 and 17 years of age. The students were randomly selected for the study, and divided into two equal groups – the experimental and control groups. The first group containing 27 students participated in horse riding classes for 10 weeks, 3 times a week for 45 minutes in the Horse Riding Centre "Equistro" in Wierzawice. The second group containing also 27 students was the control group. Furthermore, both groups participated in physical education classes in school. The horse

riding program, undertaken by the experimental group, was developed with advice from the Polish Hippotheraphy Association and the Polish Horse Riding Association.

Before starting the horse riding training and after its end both the control and experimental groups were diagnosed with the use of the Accu Sway Plus balance platform using the Balance Trainer programming from the AMTI society, with the statistical program Bio Soft. With the use of the balance platform the following parameters were determined: the centre of feet pressure against the base bearing of the child on the platform in the standing posture in the following positions: 1 (eyes open and open base – heels apart), 2 (eyes closed and open base), 5 (eyes open, base closed – heels together).

The chosen balance parameters of the Bio Soft program were statistically analyzed, registering the centre of gravity sway in the frontal and sagittal planes. The sway range (Range X [cm], Range Y [cm]), the average displacement of the gravity centre along the X and Y (DISPavgx [cm] and DISPavgy [cm]), the average velocity of the COG placement (Vavg [cm/sec]), the average radial displacement (RDavg [cm] and the length of the path covered by the COG on the basal plane (L [cm]).

The statistical analysis was executed with the use of the Statistica packet. Descriptive statistics of the registered variables were done. A distribution analysis of the tested features, which indicated no normal distribution and uniformity of variations, was also performed. With regard to this, the U Mann Whitney test was used to detect the inter-group differences, and the Wilcoxon test to detect significant within-group changes.

## Study Results

Comparing the experimental group (which undertook the horse riding training) to the control group in the first test did not present any significant inter-group changes – uniformity of the balance parameters was indicated. Stabilographic parameters did not undergo any significant changes in the control group (which did not participate in the horsy classes) at the end of the experiment.

A renewed test of the balance parameters performed after 10 weeks of the experiment for group 1 presented crucial differences within the experimental group (fig. 1, 2, 3, 4, 5), as the level of the stabilographic parameters decreased, which indicates their improvement.

In the experimental group the sway range X in the frontal plane in positions 1, 2 and 5 did not undergo a significant statistical change. However, in each of these positions was noticed a reduced sway range at the end of the experiment. Significant changes were noticed before and after the training in the case of the sway range Y in the sagittal plane (fig. 1).

A similar nature of the changes was noted in the case of the average displacement X, average displacement Y and the average radial displacement (fig. 2), which values were decreased. This attests to the positive effects of the horsy classes on the balance control level of the mildly mentally retarded children.

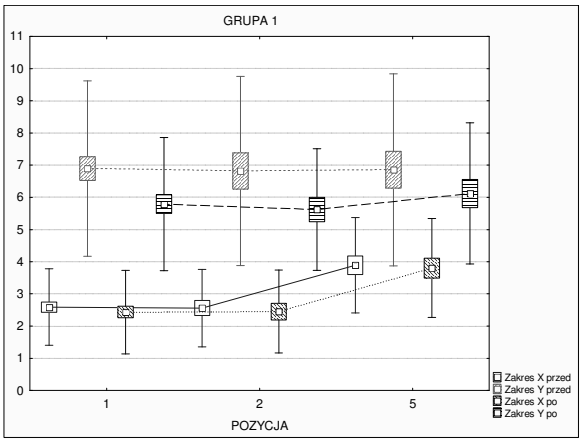


***Figure 1***

*The sway range Y in the saggital plane before (Zakres Y przed) and after (ZakresY po) the training and similarly the sway range X in the frontal plane before (Zakres X przed) and after (Zakres X po) the training in positions 1,2,5.*

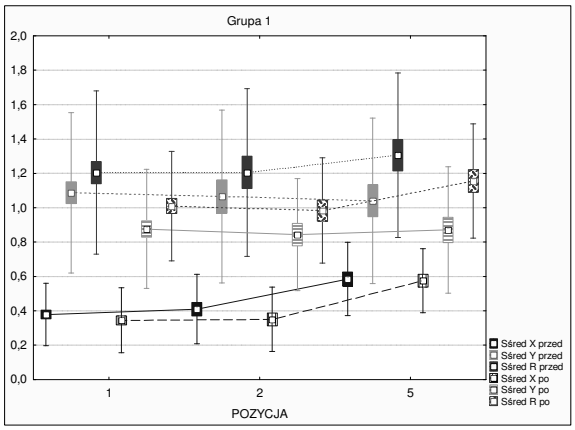


***Figure 2***

*The average displacement of the centre of gravity (COG) in the saggital and frontal planes before (Śśred Y, X przed) and after (Śśred Y, X po) the training and similarly the average radial displacement before (Śśred R przed) and-after (SśredRpo) the training in positions 1, 2, 5.*

The nature of these changes in all the analyzed positions is the same: the body sway value in the sagittal plane (fig. 3) and its range, as well as the average displacement Y in the sagittal plane decreases statistically significantly after the training {fig. 1, 2).

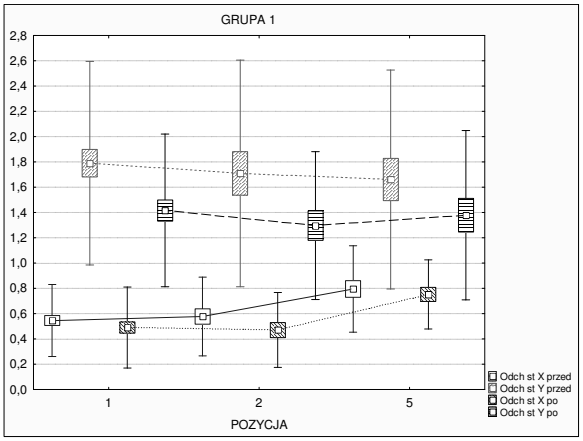


***Figure 3***

*Sway values in the saggital and frontal planes before (Odch.st. Y ,X przed) and after (Odch st. Y, X po) the training in positions 1, 2, 5.*

The same tendency is presented in the average displacement of the COG in the sagittal plane and in the average radial displacement (fig. 2), indicating a huge positive influence on the sway changes in the sagittal plane – range Y, despite the lack of significant sway differences in the frontal plane – range X (fig. 1).

Analyzing the average velocity values in all positions before and after the experimenting, also indicates better parameters after the training (fig. 4), however in position 1 and 5 it decreases statistically.

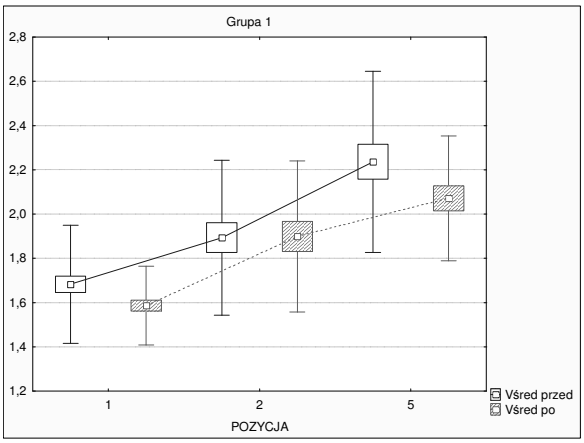


***Figure 4***

*The average velocity of the changes related to the placement of the centre of gravity on the basal plane before (Vśred. przed) and after (Vsred. po) the training in position 1, 2, 5.*

A similar tendency is presented by the parameter determining the whole length of the path covered by the COG on the basal plane (fig. 5).

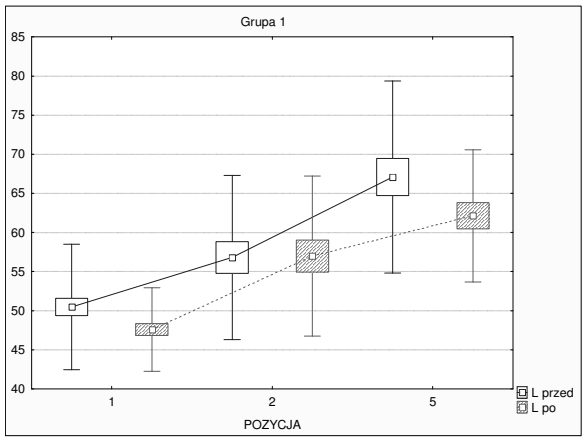


***Figure 5***

*The length of the path covered by the centre of gravity on the basal plane, before (L przed) and after (L po) the training in positions 1, 2, 5.*

## Discussion

The correct body sway coordination depends on the efficiency of the receptors of sight, proprioceptors and the sense of balance. They inform about the change of body position in space and the work of the nervous system as a regulator [6, 8, 13]. The presented results of the preformed tests indicate, that children with mild mental retardation, who undertook the 10 week horse riding training program have better results in keeping body balance in the standing position than their peers, whose physical activity is only connected with physical education classes in school. The values of all analyzed parameters have decreased, which attests to a better control over body sways [33].

The range of sways in the sagittal plane is larger than in the frontal plane, which is in accordance with other studies. This is connected with the different work specifics of the ankle and hip joints [28, 29]. The central nervous system regulates the centre of gravity placement by matching an appropriate muscular tension and stiffening of the joints. A balanced torso with its centre of gravity, located in the ninth thoracic vertebrae when sitting, located in the same axis as the axis going through the COG of the horse. It transfers the swinging moves to the limbs. The feet gather the motor waves in the place where the shank touches the stirrup. The amortized in the ankle joint foot creates pressure on the stirrup. Raising the tips of the toes during the recur happens due to the freely lowered heel; being an result of the correct placement of the legs, physiological fitness of the hip joint, mobility of the pelvis and the free connection of its moves to the torso. The motor experiences of the rider lead to the restoration of the torso, in order for it to be able to undertake the motor stimulation from the horse and to convert it into balance training as an

element of the motor coordination of a human being, normalizing the muscular tension [21, 22, 23]. This is shown by a smaller range of sways, lower values of the average sway velocity and a lower length of the path covered by the COG on the basal plane, which was affirmed in the executed experiment.

A larger sway range in the sagittal plane is connected also with the shape of the basal plane, which is similar to that of a rectangle, with the sides shorter in the frontal plane, which creates bigger possibilities in the oscillation of the centre of gravity in the sagittal plane [29, 30]. Mounting astride in the saddle frees the lower limbs from having to support the body. Automatically the surface of the plane is changed from a small quadrilateral to a larger surface. The buttocks and the inner side of the thighs contact, which gives the freedom of performing balance exercises. Balance reactions are perfecting and while gathering experience the rider less relies on his sight. Balance reactions are greatly improved without the control of sight, which is affirmed by the lower values of stabilographic parameters obtained at the end of the experiment.

Due to horse riding smaller sway ranges and smaller average velocity levels are noted in the frontal plane, but are not statistically significant. Despite this the changes of the sway range in the saggital plane, and the average displacement of the COG in this plane are so high, that they significantly affect on the average radial displacement of the COG, including the resultants of the COG displacement in the frontal and sagittal planes.

The above – mentioned tendencies show the improvement in the regulation of the balance process. In the case of a free posture with the control of sight, a decrease in the velocity of the COG displacement on the basal plane, and the length of the path covered by the COG on the basal plane – was observed after the experiment. This affirms that the control of sight and a bigger basal plane (when compared to a closed position) have a significant impact in improving the work of the balance mechanism supported by horse riding trainings. A smaller value of the average sway velocities and the length of the path covered by the COG imply, that the process of balance regulation is less energy – consuming and through it – more reliable. Moreover, the process of stopping under control of the nervous system is determined by correct balance control, which is in accordance with the information provided by other authors [30, 31, 32].

Generally all the significant changes and revealed tendencies in the studied group, which appeared in the effect of the many executed horsy classes, present improved balance reactions among children with mild mental retardation. The lack of changes in the control group indicates, that there were no other factors that could create such effects as in the experimental group.

## Conclusion

1. The 10-week horse riding training program for children with mild mental retardation has influenced changes in the balance regulation process.

2. The improvement of the stabilographic parameters concerned every one of the measured positions: the free open posture with the control of sight, and without sight and a smaller basal plane.

3. A significant improvement of the stabilographic parameters after the training was noted in the case of measuring the sway ranges and the average displacement in the sagittal plane and the average radial displacement.

4. Additionally, in the case of the free posture with the control of sight, the average velocity of the change of the COG placement on the basal plane has decreased as well as the length of the path covered by the COG, which may affirm the important role of the sense of sight and the basal plane in the regulation of the process of keeping balance.

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## RESUMÉ

## VPLYV JAZDY NA KONI NA PARAMETRE STABILITY DETÍ SO STREDNÝM STUPŇOM MENTÁLNEJ RETARDÁCIE

***Anna Mazur-Rylska – Tadeusz Ambroży – Dorota Ambroży***

Udržiavanie rovnováhy je charakterizované stálou zmenou ukazovateľov. Jazda na koni predstavuje jednu z možností jej rozvoja. Cieľom nášho príspevku je prezentovať výsledky výskumu zameraného na sledovanie a analýzu zmien vybraných ukazovateľov rovnováhy vyvolaných jazdou na koni u detí so stredným stupňom mentálnej retardácie. Výskumný súbor tvorilo 54 náhodne vybraných chlapcov so stredným stupňom mentálnej retardácie, vo veku 15 – 17 rokov, rozdelených do dvoch rovnocenných skupín: kontrolnej a experimentálnej. Experimentálny súbor bol zapojený do programu jazdy na koni počas 10 týždňov, s frekvenciou 3 tréningových jednotiek v týždni a s dĺžkou trvania tréningovej jednotky

45 minút. Rovnováhovú schopnosť sme testovali v stoji na stabilografickej platni Accu Sway Plus. Pri deskripcii polohy sme definovali: umiestnenie ťažiska, uhlové zmeny, dĺžku a dráhu ťažiska. Výsledky v experimentálnej skupine ukázali signifikantné zmeny vybraných parametrov pred a po ukončení tréningového programu. Pohyb ťažiska bol signifikantne menší v sagitálnej ako aj vo frontálnej rovine. Navyše, výsledky ukázali aj signifikantný rozdiel priemerných hodnôt medzi dĺžkou dráhy ťažiska v mediolaterálnom a predozadnom smere. Všetky štatisticky významné zmeny, ktoré sme zaznamenali ako výsledok pôsobenia 10-týždňového programu jazdy na koni indikujú zlepšenie rovnováhových schopností. Na druhej strane nedostatok zmien v kontrolnej skupine poukazuje na fakt, že sa tu nenachádzali faktory, účinok ktorých by vyvolal podobné zmeny ako v experimentálnej skupine.

# THE EFFICIENCY OF A SPECIFIC TRAINING PROGRAM FOCUSING ON THE DEVELOPMENT OF CHOSEN MOTOR ABILITIES OF 13 – 14 YEAR OLD FEMALE BASKETBALL PLAYERS IN A ONE-YEAR-CYCLE

**Mgr. Tatiana Gallová, PhD.**

The work evaluated a one-year cycle of 13 – 14-year old youth female basketball players. The cycle focused on the development of chosen motor abilities using specific and non-specific preparation techniques. It was divided into three mesocycles in which different composite methods of athletic and fundamental preparation techniques were used in connection with technical-tactical training as well as training focusing on game situations.

The thesis was in its nature an experimental work based on the evaluation of one group consisted of 14 youth players. During the experiment methods of a long – term observation, a questionnaire, the method of measurements of somatic parameters and motor abilities (general and specific), and statistical methods of evaluation were used. Further, dynamic changes were examined and the results were compared inter-individually, intra-individually, and with females of the same age of the Slovakian population.

The evaluation of the general motor performance was based on the tests of sit-ups, standing long jump (Moravec, Kampmiller, Sedláček, 1996); overhead medicine ball (2kg) throw (Moravec, 1990), modified rope skipping (20 sec), and run to the cones (Hirtz, 1985).

The specific motor performance tests consisted of the 20m sprints, 10m sprint (Sedláček, Cihová, 2009); 20m dribbling and 10m dribbling, and test lay-ups (Schnürmacher, 2001). For the specific motor performance tests, except the lay-up test, the comparison with the population was not made because there was not sufficient data found in other literary works. Since those tests are not commonly used, even if they can give a better view on the real level of the specific performance, the results were compared within the team during the season and partially with youth female basketball players from Slovenia.

The results of the somatic parameters showed that the tested players were taller and weighed more than the normal population. However, even though they were taller and their BMI was above average compared to the normal population, it was normal for their height.

Furthermore, the chronological and biological age of the tested players as well as their sport age was compared. It is known that especially the differences in biological age, mostly during puberty, can highly influence the motor performance (Šelingerová, Šelinger, Havlíček, 1995; Ortega et al., 2008). This gave a better insight on the test results, especially in the tests of specific motor performance since the tested players were approximately the same chronological age but they differed considerably in their biological age and also in their sport age.

Finally, the first testing of the general motor performance (after the off season period) showed that compared to population standards, the players were getting average or under-average scores (except one test – medicine ball throw); however, the tests made during the season showed that they were improving continuously so that by the end of the cycle they got better results than the population. The specific motor performance tests that were compared mostly inter-individually and intra-individually showed even more rapid improvement.

***Supervisor:*** *Assoc. prof. PaedDr. Anton Lednický, PhD.*

# LEVEL AND CHANGES OF SOMATHOMETRICAL, MOTOR AND PHYSIOLOGICAL PARAMETERS, THEIR RELATIONSHIP AND CHANGES AFTER TWO-YEAR AEROBIC GYMNASTICS TRAINING

**Mgr. Martina Tibenská**

The thesis was presented on the level of knowledge and changes in somathometrical, motor and physiological parameters, their relationship and the dynamics of changes in preparation of female juniors in aerobic gymnastics The research was undertaken as a longitudinal follow-up inter-character. The research consisted of a set of junior category representatives (n = 12), whose mean age at baseline was 14.08 $\pm$ 1.19 years. 23 indicators were selected from three areas – 6 somathometrical variables, 8 motor indicators and 9 physiological indicators. For the evaluation of primary data, except the calculation of basic statistical characteristics, we tested significance of differences using Wilcoxon test for paired values and also the pair correlation and regression analysis. When interpreting the results obtained and the formulation of conclusions, we relied on the basic logical methods of analysis, synthesis, using deductive and inductive procedures. The interpretation results in the formulation of knowledge and research findings indicating the contribution of monitoring for the development of theory and application of results in the sports practice. Initial analysis of the monitoring indicators we gained data that created the image on the current state of physical development and movement performance and functional fitness of the organism of the subjects. After two years of monitoring objectively – in a logical way interpreted all changes in the level of monitoring indicators and using the pair correlation and regression analysis, we assessed all the individual relationships. Results showed the influence of sports training at all levels of monitoring indicators differently, for all selected somathometrical variables, except the accelerator all the motor speed indicators with the exception of functional fitness, heart rate at rest and systolic blood pressure at rest all the physiological parameters were statistically significant. Our monitoring has confirmed the significance of the relationship with fat explosive leg strength, spatial QRS vector with all the monitoring indicators with the exception of height and dynamic strength of abdominal and hip-lumbar musculature with a systolic blood pressure at rest.

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