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ECONOMIC IMPACT AND CONSUMER BEHAVIOR OF DOMESTIC SPECTATORS IN TWO MAJOR INTERNATIONAL SPORT EVENTS ORGANIZED IN HUNGARY IN 2019

LACZKÓ TAMÁS[1,*], STOCKER MIKLÓS[2]

ABSTRACT. In this paper we describe the consumer behavior of domestic spectators in international sport events organized in Hungary in 2019. Two major international sport events are researched, the Liebherr 2019 ITTF Table Tennis World Championships and the 2019 ICF Canoe Sprint and Paracanoe World Championships. We explore the settlements level social, economic and demographic factors which influence the attendance in the researched international sport events, and we calculate the generated tourism related economic impact. In TTWC and CWC we surveyed altogether n=901 domestic spectators with the domestic spectator questionnaire and further settlements level statistical data was used in the calculations. Domestic spectators have seen on average 2.31(SD=1.71) event days, and the mean distance travelled by them were 128.1 km. Domestic spectators spent €51.7 (SD=48.86) on average per day which is significantly higher than any respective group of domestic tourist to compare. Domestic spectators of individual Olympic sports come from those settlements to the World Championships where there is strong culture of the given sport because of high level clubs. Purchasing power seems to be another significant factor as broadband was positively associated and jobseekers were negatively associated with going to the world championships as a domestic spectator. The Hungarian budget realized from the domestic spectators' expenditure in the Liebherr 2019 ITTF Table Tennis World Championships and the 2019 ICF Canoe Sprint and Paracanoe World Championships 572,901 EUR tax revenue. Whereas the Hungarian GDP grew 717,319 EUR because of the two events in analysis.

Keywords*: major international sport events, domestic spectators' spending, economic impact, consumer behavior*

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Introduction

Tourism connected to sport events are the biggest and most dynamically improving sector of sport tourism (Dreyer, 2002; Weed, 2006; Bánhidi, 2015; Borbély & Müller, 2015; Laflin, 2018). International elite sport events are the most significant type of sport events, because of their social and economic impact, their complexity and the number of different stakeholders and their influence (Stocker & Szabó, 2017). In the last few years strong trend of globalisation could be observed in international sport events and in harmony with it grew the number of spectators and the obtained revenues of the events. In major sport events the organizers shifted their focus to entertainment and providing experience to increase their events' appeal to spectators and even new type of events emerged, such as new multisport events which draw even more attention to the organizing city or country to create even more social and economic impact (Laflin, 2018; Laczkó & Stocker, 2020). In 2020 the COVID-19 pandemic caused a shock in the tourism sector and also in the sport sector and had serious negative total economic effect as well. The length and the resolution of the pandemic will determine the short- and medium-term changes in the international sport events (Campbell, Gregory & Shibata, 2020; Cooper, Alderman & Derek, 2020).

The Hungarian Government defined sport as a strategic sector in 2010 and created a sport strategy which included the objective to organize international sport events. Because of the sport strategy and the connected financial support, the number of international sport events skyrocketed and from 2017 more than 100 international sport events were organized in Hungary annually (Stocker & Szabó, 2017). In fact, in 2019 more than 120 international sport events were organized in Hungary which included the Hungarian Formula One Race, the Table Tennis World Championships, the Canoe Sprint World Championships, the Fencing World Championships and the Modern Pentathlon World Championships among others. The decade of the sport strategy resulted that in 2019 Budapest became the 3rd and Szeged the 216th in the cities ranking of organizing international sport events, and Hungary became the 18th in the country ranking (Sportcal, 2019a).

Spectators and especially domestic spectators are a very important group of the participant groups of international sport events. They are important for the organizers mostly because of their numbers, but most of them are domestic tourists, their consumption generate economic impact, and they are also affected by most of the social and environmental impact of the event as well (Kim et al., 2015; Laczkó & Stocker, 2018; Laczkó & Paár, 2018; Polcsik & Perényi, 2020). According to empirical results domestic spectators

are elemental in international sport events organized in the European Union as their proportion is from 70% to 99% of all spectators depending on the given sport (Schwark, 2005; Sportcal, 2017; Sportcal, 2018; Sportcal, 2019a; Sportcal, 2019b).

According to Laczkó and Bánhidi (2018) the Eurostat data shows that 25% of the Hungarian population has been at least once in sport events in 2015 and 9.8% of the population has been at least four times. In the European Union however, the average was 5.5% points higher for those who have been at least once in sport events in 2015. Hungarian spectators are coming from those groups in the society who have better means, geographically they are coming from medium towns and cities and families with child(ren) are over representing their proportion from the society. These characteristics are similar in other EU countries as well.

In this paper we describe the consumer behaviour of domestic spectators in international sport events organized in Hungary in 2019.Two major international sport events are researched, the Liebherr 2019 ITTF Table Tennis World Championships (heretofore: TTWC) and the 2019 ICF Canoe Sprint and Paracanoe World Championships (heretofore: CWC). We explore the settlements level social, economic and demographic factors which influence the attendance in the researched international sport events, and we calculate the generated tourism related economic impact.

Objectives

The main objectives of this paper are to understand the underlying factors which determine from what kind of settlements domestic spectators came to major international sport events in Hungary in 2019 and what determined how many domestic spectators came from different settlements. We also aim to identify the economic impact of domestic spectators in major international sport events organized in Hungary in 2019.

Materials and Methods

To obtain information about domestic spectators' consumer behavior we used the survey methodology. We created a questionnaire specialized to domestic spectators and interviewers were sent to the events to select a simple random sample from domestic spectators and record their answers.

In TTWC and CWC we surveyed altogether n=901 domestic spectators with the domestic spectator questionnaire, which means our sample easily qualifies as a large sample.

The differences of the given variables, depending on the type of variables will be calculated with One-sample T tests, Independent-Samples T tests, Chi-square tests and ANOVA tests. Significance level is set at $p < 0.05$ (Ács, 2009; Ács, 2014).

Further primary research data was provided by the local organizing committee about the budget of the events and the number of different participants. According to secondary sources, we used public data from the national sport associations about the clubs in Hungary, the Hungarian Statistical Office (KSH) database from which we downloaded data about Hungarian settlements, especially all 175 townships of Hungary are covered with demographic, development related, sport infrastructure statistical data. Geographical data was also used about the distance between host city and home settlement.

We estimated the different variables' contribution to the likelihood of whether people go to international sport events with logistic regression and the different variables' contribution to the number of people going to international sport events as domestic spectators in Hungary with linear regression. Forward method of regression was applied to capture those variables which has the most contribution to understanding the dependent variable (Sajtos & Mitev, 2007).

The economic impact of the domestic spectators' expenditure was estimated with obtained multipliers from the input-output analysis of Hungarian sectors (Stocker & Boda, 2018). Domestic spectators' spending were directed to Arts, entertainment and recreation, Accommodation and food service activities, Manufacture of food products, beverages, and tobacco products, Transportation and storage. Multipliers were applied according to the expenditure in the different segment and the segments multiplier from the Hungarian economy. With these calculated multiplier effect, we could estimate the impact of foreign spectators' expenditures on the Hungarian GDP.

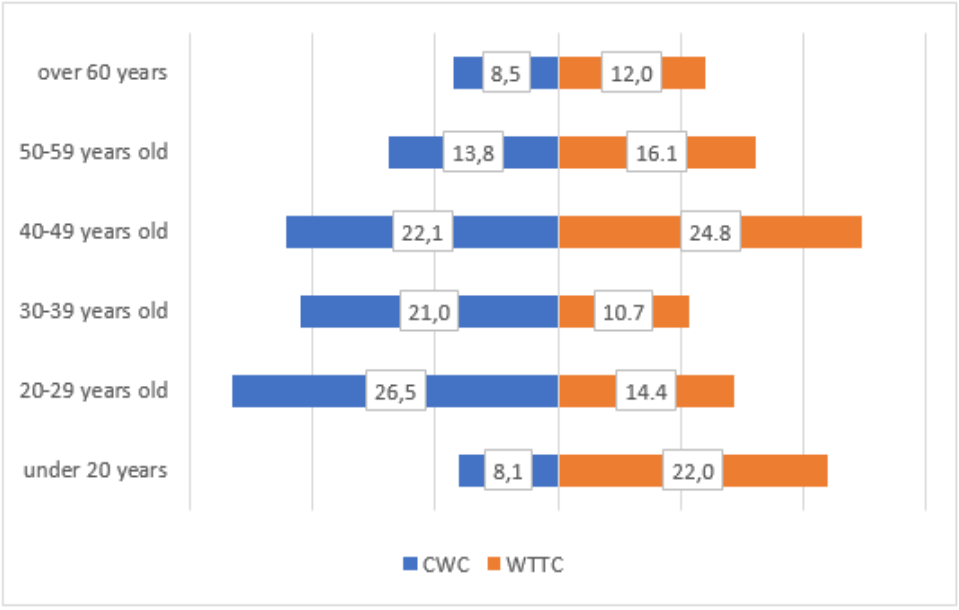
All statistical calculations were made in IBM SPSS Statistics 25 and for other calculations Microsoft Excel (from Microsoft Office 365 ProPlus) were applied.

Results

In the two world championships in analysis 62.4% of the domestic spectators were men. There was significant difference between domestic spectators' gender in the table tennis and canoe world championships ($\chi^2=41.023$, $p=0.000$) as in WTTC domestic spectators were mostly men (75.2%) but in CWC only 54% was men. This difference is because the two Olympic sport has very different audience in Hungary. CWC seems to be a family event as WTTC was more for the professional audience.

The age distribution of domestic spectators can be seen in table 1. According to age in WTTC there were more people from the younger generations and from the older generations, but in CWC the 20-29 and 30-39 years old were in bigger proportion. Differences between the two event was significant (χ^2=34.373, p=0.000).

Table 1. The age distribution in Canoe World Championships and Table Tennis World Championships (in %)



Source: Authors' compilation

Spectators came from every county of Hungary to the two world championships in analysis, although solely to the Canoe World Championships spectators came only 17 out of 19 counties. From the organizing city came 30.6% of the domestic spectators and the mean distance travelled by all domestic spectators were 128.1 km (SD=95.76). According to distance measured in time 29.3% of the domestic spectators came from more than 2 hours distance. Car or minivan was the most used for transportation as 74.2% of the domestic spectators reported this type. Public transportation was also a well-used method

to arrive to the event (15.8%) used by some spectators coming from the organizing city. Train and bus were used by 6.4% of the domestic spectators and other methods were used by only 3.7% to arrive to the event.

Around half of domestic spectators arrived with family and relatives (47.8%) and 27% reported to arrive with friends, 19.8% with teammates and only 11.3% arrived alone. According to differences in the two events analyzed CWC turned out to be even more of a family and friends event, as 79.1% reported to come with them to the event (χ^2=52.749; p=0.000). In WTTC more professional audience (37.4%) were in attendance and 22.1% came alone (χ^2=94.765; p=0,000).

There were altogether 15,402 domestic spectators in the two world championships in analysis (WTTC: 5,577 person, CWC 9,825 person) and they have seen on average 2.31 (SD=1.71) event days. Accommodation in connection with the event was rented by 31.5% of the spectators. Domestic spectators of the two world championships were responsible for 14,671 guest nights, which means on average 0.94 (SD=1.74) guest night per domestic spectator. In Szeged there was significantly (F=17.47, p=0.000) more guest nights per domestic spectator on average 1.13 (SD=1.73) than in Budapest (0.64, SD=1.71). Rented apartment were the most common type of accommodation used by those who rented accommodation with 30.3%, which was closely followed by sleeping by friends (28.2%). Higher quality accommodations like 3-star or higher hotels were only used by 20.7% of domestic spectators and the rest rented 1-2-star hotels (9.5%) or other accommodations (11.3%).

Domestic spectators in CWC spent on average € 54.4 (SD=45.2) per event day whereas in WTTC they spent on average € 47.5 (SD=49.1) per event day which means altogether €51.7 on average per day (SD=46.9) was spent by domestic spectators in the two world championships in analysis. These spending amounts are significantly higher than the average € 20.6 EUR (t=19.9, p=0.000) spent daily by the average Hungarian tourists on multi-day trips in Hungary in 2019, and also significantly higher (t=17.3, p=0.000) than the average spending of domestic sport tourist, which is € 24.7.

In table 2 the spending distribution of domestic spectators can be seen in the world championships in analysis. It is interesting to see that domestic spectators spent the most on average on entrance fees, as world championships usually have medium or low entry fees. Domestic spectators spent 27.8% of their total expenditure in connection with the event on entrance fees, 17.6% on travel costs, 15.3% on accommodations, 17.8% on hot meals or restaurants, 10.4% on other consumption, 10.5% on shopping an only 0.6% on anything else.

Table 2. Spending distribution of domestic spectators in the world championships in analysis

	Entrance fee	Travel costs	Accommodation	Hot meal/ Restaurant	Other consumption	Shopping	Others
WTTC	31.7%	18.8%	6.6%	14.1%	6.8%	21.7%	0.2%
CWC	25.7%	16.9%	19.8%	19.7%	12.2%	4.8%	0.8%
Total	27.8%	17.6%	15.3%	17.8%	10.4%	10.5%	0.6%

Source: Authors' compilation

Discussion

Descriptive statistics are very important about domestic spectators in different type of international sport events. As we explored the characteristics of Hungarian domestic spectators coming to major international sport events their per capita or per event day data can used in other major international sport events. These benchmarks can only be used however in similar type of event, i.e. other World Championships of individual Olympic sports, team sports, hallmark events, or world cup events would need their own empirical based benchmarks.

It is also interesting to see which factors determine whether spectators come from given settlements or how many spectators come from the different settlements as well. We have created the first regression about whether domestic spectators arrived from a given settlement to the two World Championships or not? The logistic regression model created can be seen in table 3.

Table 3. Logistic regression model of the determinants whether domestic spectators came from a given settlement or not

What determines whether domestic spectators came from a given settlement or not?			
	T-test	**logistic regression**	
Demographic variables	**p value**	**p value**	**Exp(B)**
Number of inhabitants	**0.009**	0.162	
Natural increase per 1000 inhabitants	0.230	0.066	
Migration balance per 1000 inhabitants	**0.000**	0.280	
Number of marriages per 1000 inhabitants	0.393	0.818	
Infant mortality rate per 1000 inhabitants	**0.010**	0.429	

What determines whether domestic spectators came from a given settlement or not?			
	T-test	**logistic regression**	
Developmental variables (labour market or economic related)			
Built dwellings (pcs) per 1000 inhabitants	**0.000**	0.785	
Broadband connectivity (pcs) per 1000 inhabitants	**0.000**	**0.022**	**1.01**
Number of registered jobseekers (person) per 1000 inhabitants	**0.000**	**0.000**	**0.958**
Number of fostered workers (person) per 1000 inhabitants	**0.000**	0.457	
Revenues of local government per inhabitant	**0.020**	0.770	
Expenditures of local government per inhabitant	0.100	0.397	
Variables related to sport infrastructure			
Playgrounds, gymnasia, resting areas (m2) per 1000 inhabitants	0.754	0.227	
Number of sport stadia, sports-grounds (pcs.) per 1000 inhabitants	**0.000**	0.129	
Level of table tennis and canoe/kayak club(s)	**0.000**	**0.000**	**1.538**
Geographical variables			
Distance from the World Championship(s)	**0.000**	0.058	
Model values	χ^2 test	***76.313***	
	Sig .	***0.000***	
	Nag. R^2	***0.474***	

Source: Authors' compilation

Table 3 shows, that the explanatory power of the model is 0.474 and three variables are influencing whether domestic spectators come from a given settlement or not (including other significant variables did not increase the explanatory power of the model). The better the table tennis or canoe/kayak club is in the settlement the more chance there is that people will go to world championships. Broadband connectivity was also positively influencing the dependent variable, therefore the more broadband connections are in a settlement the more chance there is that people will go to world championships. Definitely there were advertisement on the internet but most probably this variable is in connection with the purchasing power of people in the given settlement instead of internet advertisement. Number of registered jobseekers are negatively associated with the dependent variable, which means the more jobseeker in a settlement are the less people will go to world championships. This variable is also connected with purchasing power.

The results are even more clear if we try to identify the variables which determine how many domestic spectators come to the world championships from a given settlement (see table 4.)

Table 4. Linear regression model of the determinants of how many domestic spectators come from a given settlement

Number of domestic spectators if they come from a given settlement				
	corr	**Linear regression**		
	p value	**p value**	**Exp(B)**	**B**
Demographic variables				
Number of inhabitants	**0.000**	**0.000**	**0.702**	**0.000097**
Natural increase per 1000 inhabitants	0.345	0.675		
Migration balance per 1000 inhabitants	0.341	0.633		
Number of marriages per 1000 inhabitants	0.760	0.723		
Infant mortality rate per 1000 inhabitants	0.911	0.828		
Developmental variables (labor market or economic related)				
Built dwellings (pcs) per 1000 inhabitants	**0.012**	0.831		
Broadband connectivity (pcs) per 1000 inhabitants	**0.000**	0.633		
Number of registered jobseekers (person) per 1000 inhabitants	**0.008**	0.730		
Number of fostered workers (person) per 1000 inhabitants	**0.014**	0.822		
Revenues of local government per inhabitant	0.394	0.629		
Expenditures of local government per inhabitant	0.806	0.657		
Variables related to sport infrastructure				
Playgrounds, gymnasia, resting areas (m2) per 1000 inhabitants	0.903	0.734		
Number of sport stadia, sports-grounds (pcs.) per 1000 inhabitants	**0.003**	0.919		
Level of table tennis and canoe/kayak club(s)	**0.000**	**0.010**	**0.194**	**1.855**
Geographical variables				
Distance from the World Championship(s)	**0.003**	0.069		
Constant				**-5.132**
Model values	Ftest	***68.538***		
	Sig.	***0.000***		
	Adj. R²	***0.622***		

Source: Authors' compilation

It can be seen in table 4 that if domestic spectators come from a settlement than the number of domestic spectators are determined by the level of table tennis or canoe/kayak club(s) in the settlement and the number of inhabitants in the given settlement. The explanatory power of the model is quite high with the adjusted R^2 is 0.622.

This can be explained as there are fans in those settlements where there are bigger clubs in the given sport and in bigger settlements there are more potential domestic spectators.

In the two major international sport events researched, TTWC and CWC 15.402 domestic spectators were entertained. These spectators watched 35.300 competition days from the two championships altogether and spent 14.671 guest nights in Hungary.

Figure 1 shows the GDP contribution of domestic spectators' spending. According to the expenditure structure in the sample and the different VAT proportion in the given segments 403.666 EUR VAT was paid to the Hungarian budget. In Hungary, VAT balance is paid to the budget, but it has to be taken into account that the VAT balance of one company is connected to the VAT balance of other companies, which means after all the VAT paid by domestic spectators flows into the Hungarian budget. On top of this, tax revenues from domestic spectators' occupancy tax was 17.179 EUR and social security and personal income tax was 83.785 EUR regarding the two world championships in analysis.

Net spending of domestic spectators in the two world championships in analysis was 1.138.264 EUR from which 7.97% went on import goods. According to the Hungarian economy's input-output model the sectoral fiscal multipliers weighted by the net expenditure minus import was 1.68, which means the domestic spectators' expenditure generated 1.746.433 EUR net revenue in Hungarian companies. Calculating further with the weighted sectoral added value proportion these spending generated 649,048 EUR added value. Generated taxes minus grants and tax incentives above added value was 68.270 EUR, which means altogether Hungarian GDP increased with 717.390 EUR from the domestic spectators' spending of the two world championships in the analysis.

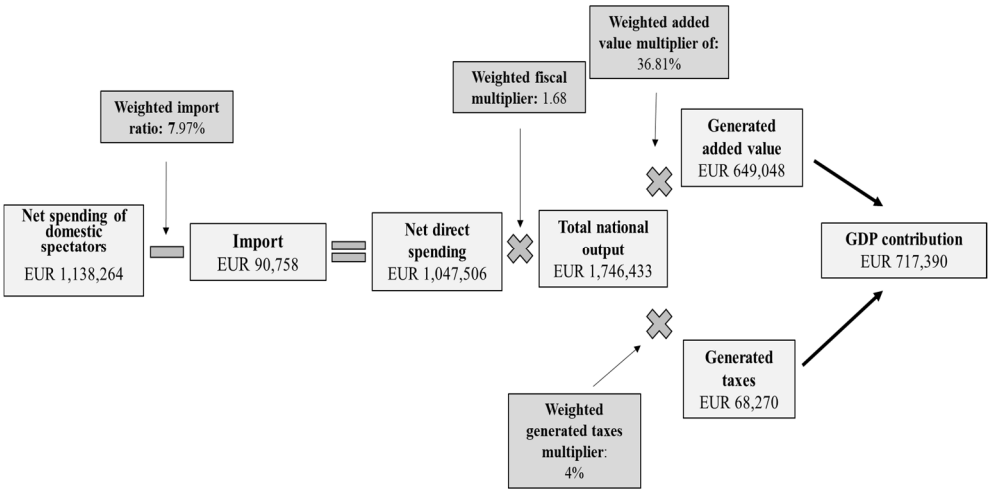


Figure 1. Contribution to the Hungarian economy of domestic spectators entertained in TTWC and CWC (Source: Authors' compilation)

Conclusions

Major international sport events from Olympic sports are changing from professional focused events to entertainment and experience providing events with strong professional focus. Most of the domestic spectators are coming with family, friends or mates and only a handful of spectators are coming alone as the experience can be even better if shared with others. Domestic spectators of the two world championships were responsible for 14.671 guest nights altogether.

Although the differences in organizing world championships in the capital or in the country can be clearly seen, such as more guest nights and more expenditure on accommodations in the countryside, and more people coming from the capital without spending guest nights but shopping for professional items in the event organized in the capital, but these two world championships shared several common characteristics.

Domestic spectators of individual Olympic sports come from those settlements to the World Championships where there is strong culture of the given sport because of high level clubs. Purchasing power seems to be another significant factor as broadband was positively associated and jobseekers were negatively associated with going to the world championships as a domestic spectator.

If we focus on those settlements from where domestic spectators arrived to the world championships we can see, that the better the club in the given sport and the bigger the settlement is the more domestic spectator arrive to the event.

The Hungarian budget realized from the domestic spectators' expenditure in the Liebherr 2019 ITTF Table Tennis World Championships and the 2019 ICF Canoe Sprint and Paracanoe World Championships 572.901 EUR tax revenue. Whereas the Hungarian GDP grew 717.319 EUR because of the two events in analysis.

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ANALYSIS OF THE EFFICIENCY OF THE HUNGARIAN HERACLES-PROGRAMS THROUGH HUNGARIAN MEN'S BASKETBALL

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ABSTRACT. One of the key elements of high-level youth development strategy is that we select the talented youngsters with adequate, scientifically based methods. In Hungary this is supported by the Heracles programs (Heracles Champion and Heracles Star Program), which have the explicit goal of educating a selection of athletes who have the opportunity to pursue a professional career. We wanted to investigate the effectiveness of the programs by placing men's basketball in the focus of our research. We analyzed players who entered the Heracles programs but had already reached the peak of their careers. The sample thus consisted of 143 people, these players could already present themselves in the senior national team with a realistic chance. We used descriptive statistical methods, relying on the website of the domestic and international basketball association, the website of the Heracles programs, and the eurobasket.com paid page. We found that 80% of the surveyed players had the opportunity to introduce themselves in the Hungarian first or second division, however, for a longer period of time, the athletes stayed primarily in the second division. Those who have started a career abroad, played mainly in second-class or less-registered championships. Most of the players who are currently selected by the senior Hungarian national team are playing for a domestic Hungarian first class team. 2/3 (N=63) of the Heracles players with national youth selection debuted in the first class and 1/5 (N=20) in the second division, so the youth selection and Heracles membership together can be a serious selection factor. According to our research debuting in the senior national team without Heracles and national youth selection causes big difficulties, not a single "Heracles age" player played more than one senior national tournament without these two criteria. We also observed some anomalies in selection efficiency (relative age effect, territorial distribution), however, forward-looking federal intent and new regulations predict an increase in playing minutes for young players and a more lasting use in first division.

Keywords*: youth strategy, talent selection, basketball players, sport career*

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Introduction

The Hungarian Heracles program was created with the aim of identifying talented players and tracking their careers using scientific tools as a key element of a new kind of youth development strategy. The Heracles Champion program began in 2001 with 13 sports, and today it sums up the future hopes of 20 Olympic sports. The primary goal of the project was to manage athletes between the ages of 14 and 18 with a scientific background, training camps and training opportunities to create the conditions for quality youth education and the financial and professional background necessary for adult sports success. It has emerged as an explicit task as the guiding principle of the program is to ensure that selected players reach the age-old international standard. The responsibles for the Champion program are the Hungarian sports federations, their competence extends to the selection of coaches and athletes, and to the development of professional programs. The key to the success of the program is the controlled state support.

From the beginning of 2006, the Heracles Star Program made it possible for selected athletes to compete regularly and internationally until the age of 23, thus opening up even more opportunities for patrons to professionalize. As long as nearly 1,350 athletes have been registered in the Champion Program, the careers of nearly 400 athletes have been supported under the Star Program at the expense of sports-specific funding that can be drawn by associations. In order to monitor athletes and select them as efficiently as possible, the National Sports Institute, which manages the programs, is still working closely with the relevant associations.

Our research focuses on the analysis of basketball players participating in the Heracles programs, with the goal of focusing on Heracles athlete membership as a selection indicator. Analyzing the performance of athletes, Harsányi (2009) concluded that youth competitions can be important selection indicators in terms of adult performance. Brouwers et al. (2012) investigated tennis players and came out the same conclusion. We wanted to find out if "Heracles membership" could predestine you for a professional career? We were curious about the proportion of the athletes who managed to achieve the first and second-class. At the other extreme, what is the proportion of athletes who, although selected in the Heracles programs, have not achieved a registrable professional career? In order to quantify the effectiveness, we also wanted to examine the goals of the program, the youth selection, and the existence of the senior selection between the Heracles players.

Methods

The database of Heracles athletes was selected on the basis of the www.nupi.hu website. Based on the filtered data, a total of 802 people were registered in the database, which includes both men and women. As the competitive system of women and men, their maturation process, the length of their careers, the number of people practicing the sport, their television and on-site views, and many other factors differ significantly, it is advisable to differentiate the measurements according to gender. The focus of the present research was on male athletes. Different sports can project different sports career lengths, and the maximum performance also falls at different times. (Ericcson, 1990; Allen & Hopkins, 2015). According to research in our analyzed sport (Longo et al., 2016), the peak is reached by basketball players at age 27-28.

Athletes often announce the end of their professional sports careers in basketball around the age of 40. In order to get a proper picture of the effectiveness of the Heracles programs, we had to choose a sample that was representative of the snapshot associated with the program. Players selected from the sample who have been there since the beginning of the program are already at the adult level and, according to the literature, may be beyond or at the peak of their performance. Based on these parameters, we selected all the Heracles players who were born between 1986 and 1991, and they had a realistic chance of participating in the last adult European Championship. Our study was two-way, as we looked at the careers of the selected Heracles athletes, we analyzed the Hungarian senior team of the last 12 years, and looked at which of them were Heracles athletes and whether they were among those selected at the age of Heracles arriving from outside the filter.

A total of 143 Heracles athletes were subject of our analysis according to the parameters we provided. Descriptive statistical methods were used for the research. In our study, we relied on the relevant data of MKOSZ (Hungarian Basketball Federation), and FIBA archives, the NUPI database, and the paid page www.eurobasket.com. Based on the database available to us, we also looked at the relative age effect as well as the home grown cities of the senior national team's Heracles athletes. We considered the headquarters of the youth clubs of the athletes' database indicated on the website www.nupi.hu to be home grown cities.

Data cleaning was performed first, we classified the variables and created groups. The following data was gathered: name, birthdate, birth quarteryear, highest league participation, league type of the longest participation of the player, youth national selection, type of youth national selection (U16, U18, U20), playing abroad, and raising club.

We marked the existence of a variable with numbers (YES:1, NO:0). League levels, birth quarteryears were also indicated with numbers (1-4), with the raising clubs' names we relied on the database of the Heracles progams. We used descriptive statistical analysis like: mean, modus, standard deviation, minimum and maximum values, and the percentage distribution of the players. Microsoft Excel 2013 helped us to get the following results and charts. When we gathered information about the current regulations and competitions, as a qualitative method, document analysis was also included in this research.

Results

We first examined the mainly articulated national youth selection among the Heracles athletes. 65.73% (N = 94) of the players participated in some kind of national youth tournament, however 34.76% (N = 49) despite the fact that they were chosen to be Heracles members, never got the chance to play on a youth national tournament. Out of these players 18 people could not be step out from the amateur level, but it is remarkable, that 17 players reached the first division and played in the Hungarian first league. 14 players who were not selected at youth age at international level later played at least once at the second divison.

We got a more shaded picture if we look at how many of the players who,- despite their membership in Heracles, never entered the European Youth Championships- were permanently applied in the first class. This performance was realised by four athletes, 22 players were second-level players for a longer period of time. 23 players were introduced in the first class, but for a variety of reasons they dropped out, stopped the game or continued as amateurs.

67.02% (N = 63) of the Heracles athletes with the youth national selection were able to present themselves in the first division of the men's basketball championship. 21.27% (N = 20) of the players only took it to the second division in this context, and 10 people did not advance beyond the amateur level. We registered a youth national team player who immediately continued his career abroad as a Heracles and youth national team player. We obtained data that correlated better with the athlete's actual performance level when we looked at where the Heracles members of this youth selection team spent most of their time in their careers so far. Most of them reached the first league (39.36%, N = 37 people), as well as a significant proportion of the players who were in the second division the most (38.29%, N = 36 people). For 7 (7.44%) athletes, foreign careers became dominant, and 14 people (14.89%) continued as amateurs or stopped playing.

Overall, the career maximums of the athletes studied are shown in the figure below:

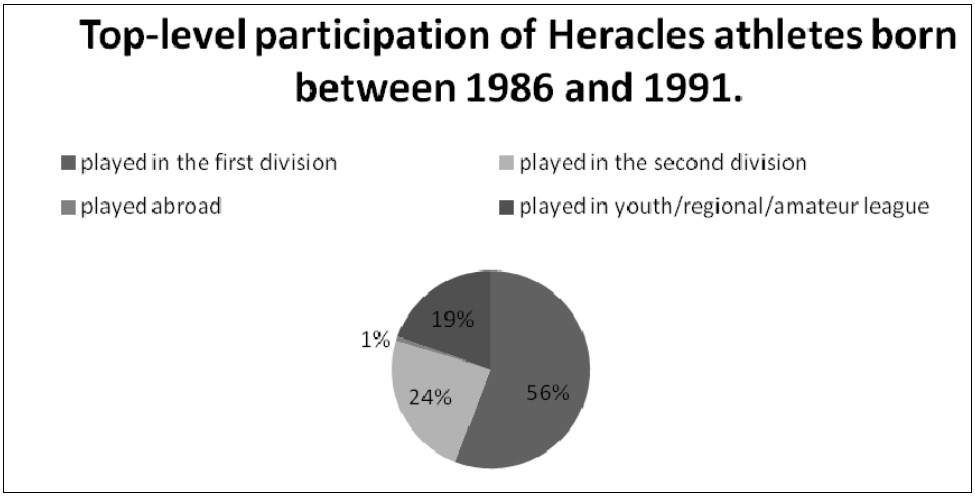

Figure 1. Top-level participation of Heracles athletes born between 1986 and 1991 (figure made by the authors)

4/5 of the players (N=114) made it to one of the Hungarian professional leagues (first and second division) for at least one match. This is considered to be a particularly good ratio, which means in this aspect that 8 out of 10 Heracles athletes can get a chance to make a living from basketball. However, not everyone can take advantage of this opportunity, and trust in players is sometimes due to short-term, competitive regulations. The current MKOSZ (Hungarian Basketball Federation) guidelines (MKOSZ, 2020-2021), as well as next year's competition notice, also encourage young people to enter the field and force clubs to apply young players. In our opinion, this may, among other things, induce an increase in the proportion of Heracles athletes in first-class frameworks.

One-time step ups may give a false picture of the real knowledge and level of the players, so we also looked at the most significant stages in the careers of all the athletes studied so far and what level these stations represented. Accordingly, the following results were realized:

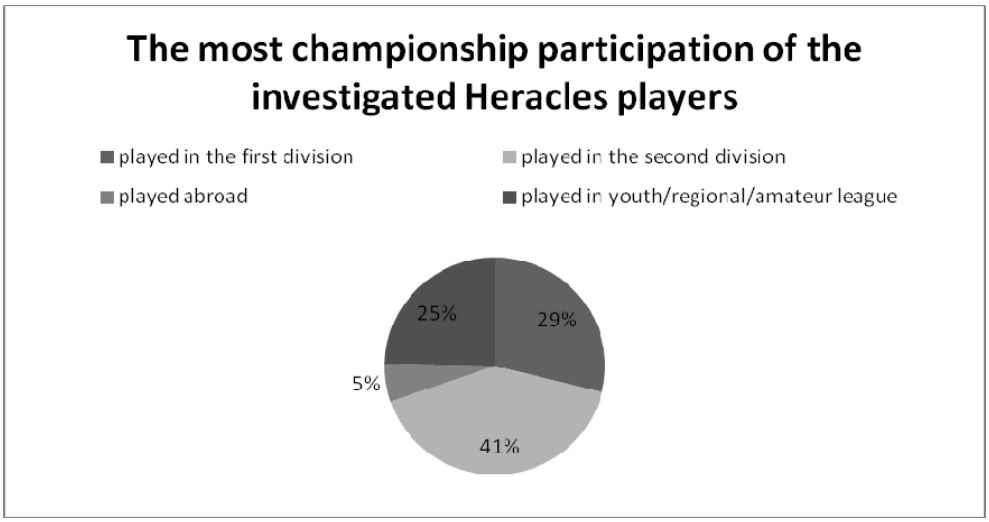

Figure 2. The most dominant level of the athletes so far (figure made by the authors)

In the first division, the number of players who grabbed for a longer period of time decreased from 56% to 29% (N=41). In contrast, the proportion of second division athletes who enter the field most often on that level increased from 24% to 41%. (N=58). We can discover interesting tendencies among those who choose a career abroad, as many have appeared in foreign second division or lower quality first division championships, however, of those who have been playing abroad for a long time, only Ádám Hanga is a decisive member of the senior Hungarian national team.

Among the youth clubs, most players were selected from the following during the period under review:

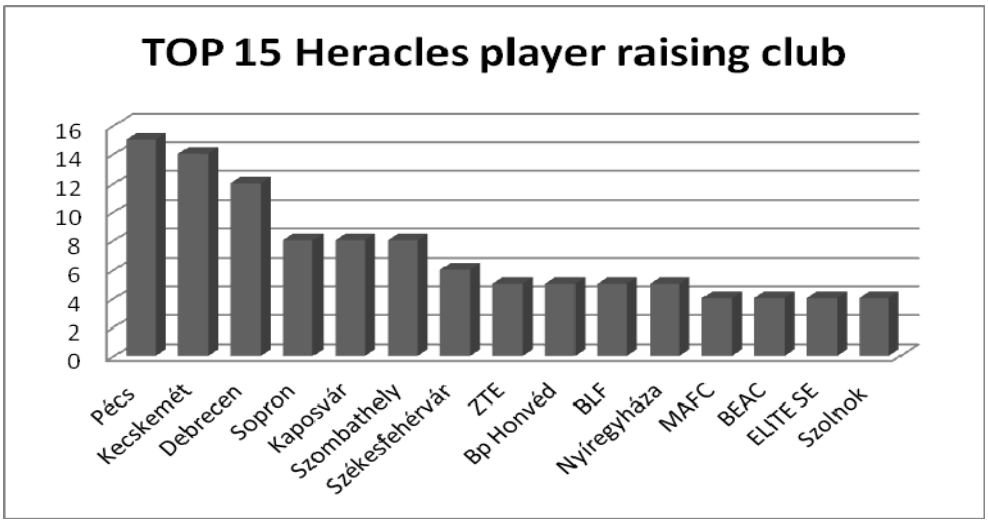

Figure 3. The top 15 Heracles player raising clubs at the selected period (figure made by the authors)

On the podium there are Pécs with 15 players, Kecskemét with 14 players and Debrecen with 12 players. Budapest provides the most players (N=35), however, it was calculated separately for each club due to its sports organizations with significant traditions (eg MAFC, Vasas). We considered it appropriate to compare the number of Heracles athletes raised by clubs with the number of Heracles athletes raised by their club and allowed to present themselves in the senior national team. To this end, we examined the framework composition of the adult national teams of recent years from Eurobasket 2009 qualifiers to Eurobasket 2017 Final Round. We saw a striking difference in that as long as the Heracles athletes included in the programs covered several segments of the country, the senior team was represented only by Kecskemét (3 people) and Szolnok (1 person) from the eastern part in the case of Heracles members. At the other hand 16 Heracles players were included in the national team from the western region. A total of 42 players have been invited to senior matches since the 2009 qualifiers, of which 23 players (54.75%) were "Heracles of Age" (1986 or younger) athletes. Three adult national team players did not fall within the reach of federal decision-makers when the framework for the Heracles program was put together, yet they created the opportunity for themselves to represent on the adult national team. Based on our analysis, it can be said that without a Heracles membership, it is a very difficult task to

get on an adult national team and even more difficult to be a defining player there. None of the players from outside Heracles but "Age of Heracles" entered the field in more than one qualifying series.

Discussion

Related to our data, it can be stated that the examined "Heracles membership" as a selection factor (80% of the analysed players reach the professional levels) can most likely predestine to a professional (national first or second league, abroad) career. Reaching the highest step for a longer period of time and compete in the first division is a difficult challenge, over the years many of them crumble for a variety of reasons. Our results show that Heracles basketball players play abroad mostly at second divisional teams, the Hungarian first league is the largest base of the adult national team. We cannot avoid the fact that a quarter of the Heracles players selected by the association (n =35) did not reach at least the second division, continued to play basketball at the amateur level, or stopped over time. We consider it important that this ratio decreases and the number of hungarian Heracles players in the first class increase for a longer period of time. There is a strategic intention for this aim at the federal level, and the professional and financial conditions for this are increasingly given.

Increased attention should also be paid to the relative age effect (Delorme et al. 2009,2011), as few children represent the last quarter of the year in the Heracles selection. 12% of the total sample was born in October, November, December. In 6 players it can be observed the so-called "Rocky road theory" (McCarthy and Collins, 2014), which assumes that players born at the end of the year is a disadvantage compared to their more matured teammates who born at the beginning of the year. At the end these players surmount their disadvantages and become important players due to their perseverance and work ethic. They were all able to introduce themselves in the first division, and they were also taken into account in the youth national teams.

Conclusion

The question that arises and has to be researched is where do the youth selection of Heracles athletes dissapear, who do not professionalize, do not get into first and second league frameworks. The basis of our further research will be to discuss the careers of the youth national team players and the key stages of a professional athlete's career.

Although many young Heracles players were able to play at least a game in the first league among the athletes surveyed, their highest proportion (58 people, 41%) was more likely to prevail in the second division for a longer period of time. In our opinion, this is due to the annual championship regulations, as well as the ownership and coaching decisions, since in the first league the decisive proportion of the playing minutes is given to the expatriates and the dominant, older Hungarian players. At the moment, the teams cannot employ a foreign player in the second division championship, which further facilitates the entry of young Hungarians there.

The aim of the association is to get as many young athlete as possible to compete at the highest level, for which it will give all support to the best of its ability. The effective work of academies and youth development clubs remains essential to achieve this goal. Although Heracles programs are geographically diverse at the senior national team level, the selection is strongly western-centered. Resolving this requires a two-pronged approach: on the one hand, optimizing federal selection processes and developing a broader perspective, and on the other hand, rethinking the youth developement strategy of sports organizations representing the eastern region of Hungary, and a kind of more effective youth training. The goals are clear: to nurture young talents who can compete at the highest adult levels. We think that investigating the efficiency of the Heracles-programs could not be a one time occasion. The changes of the competition systems can make it difficult, but as more and more player comes out from the youth levels we can have a more punctual look at the efficacy of the selection. Further research is needed in this context.

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THE ATTRACTIVENESS OF A DIDACTIC GAMIFICATION MODEL TESTED IN A POSTGRADUATE PROGRAM

VĂIDĂHĂZAN REMUS[1,*]

ABSTRACT. Gamification has emerged as a new approach in solving daily tasks, in various fields, by applying the concepts used by digital game designers, being defined by some promoters of this system as "a process of using game thinking and game mechanisms to involve the user in solving problems" (Zichermann, 2011). Since its conceptual beginnings, somewhere near 2010, gamification has attracted more and more attention from researchers and practitioners, and this has led, according to Koivisto & Hamari (2019), to the implementation of gamification in several areas. As for gamified learning in higher education, it has only received attention since 2013, but has grown rapidly since then (Subhash & Cudney, 2018). The main objective of this research was to measure the level of attractiveness of my first model of didactic gamification, on a reduced structure of only 6 work units. This didactic gamified model was highly appreciated by the participants and was rated valuable on both its qualities: pragmatic and hedonic.

Key words: *gamification, didactics, model, teaching, university.*

REZUMAT. ***Atractivitatea unui model de gamificare didactică testat într-un program postuniversitar*****.** Gamificarea a apărut ca o nouă abordare în rezolvarea sarcinilor zilnice, în diferite domenii, prin aplicarea conceptelor utilizate de designerii jocurilor digitale, fiind definită de unii promotori ai acestui sistem ca „un proces de utilizare a gândirii jocurilor şi a mecanismelor de joc pentru implicarea utilizatorului în rezolvarea problemelor "(Zichermann, 2011). Încă de la începuturile sale conceptuale, undeva în apropiere de 2010, gamificarea a atras din ce în ce mai multă atenţie din partea cercetătorilor şi practicienilor, iar acest lucru a condus, potrivit Koivisto & Hamari (2019), la implementarea gamificării în mai multe domenii. În ceea ce priveşte învăţarea gamificată în învăţământul superior, aceasta a primit atenţie doar din 2013, dar s-a dezvoltat rapid de atunci (Subhash & Cudney, 2018). Obiectivul principal al acestei cercetări a fost măsurarea nivelului de atractivitate a primului meu model de gamificare didactică, pe o structură redusă de doar 6 unităţi de lucru. Acest model didactic gamificat a fost foarte apreciat de participanţi şi a fost apreciat ca fiind valoros atât pentru calităţile sale: pragmatic şi hedonic.

Cuvinte cheie: *gamificare, didactică, model, educaţie, universitate.*

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Introduction

The act of doing something similar to the game is not something new. Over time, people tried to make their activity interesting and even fun, and when a small group of people decided to compete with each other in hunting or a competition and began to keep track of their activities and to compare their scores, then they adopted principles that predominate in modern games to make tasks more engaging (Chou, 2016).

In recent years, gamification has become a very common term thanks to digital game developers who have moved from making simple games aimed only for children to games with strong social involvement and intensely promoted on mobile devices (e.g. Farmville and Angry Birds) which aim also middle-aged people, but elderly people, too (Chou, 2016). Moreover, digital games have entered our daily lives at a fast pace and have now become a major form of entertainment, enjoyed by people from all demographic groups (Koivisto & Hamari, 2019).

Gamification has emerged as a new approach in solving daily tasks, in various fields, by applying the concepts used by digital game designers, being defined by some promoters of this system as "a process of using game thinking and game mechanisms to involve the user in solving problems" (Zichermann, 2011).

Since its conceptual beginnings, somewhere near 2010, gamification has attracted more and more attention from researchers and practitioners, and this has led, according to Koivisto & Hamari (2019), to the implementation of gamification in several areas. As for gamified learning in higher education, it has only received attention since 2013, but has grown rapidly since then (Subhash & Cudney, 2018).

The presence of technology in classrooms has inspired the shift from traditional courses to integrated digital learning environments. These interactive learning environments support the evolution of the teaching process by incorporating game elements that have already demonstrated that they can capture users' attention, motivate towards goals and promote competition, effective teamwork and communication. Gaming and game-based learning systems aim to bring these benefits to the teaching process even to the university level (Subhash & Cudney, 2018).

With the popularization of gamification, which manifested itself in a growing number of gamified applications, research on the effects of gamification also advanced rapidly. What is, however, a big problem for both researchers and practitioners is that scientific research has advanced mainly without an agenda, theoretical guidance or a clear picture of the field (Koivisto & Hamari, 2019).

With all this knowledge gained about gamification so far, in reality a complete gamification of a course can sometimes be difficult to design for three main reasons (Koivisto & Hamari, 2019, p. 199):

1) Games are complex, multifaceted, and therefore difficult to holistically transfer to other environments;

2) Gamification involves motivational information system design which entails an understanding of (motivational) psychology; and

3) The goal of gamification is often to affect behavior, and this adds yet another layer to the scope of gamification design.

In my opinion, at a macro level, gamification of teaching process means to plan the best "game experience" for a student who processes the material of my course and to whom is asked to properly solve, with specific deadlines, the tasks imposed by the teacher, whether assigned individually or in teams. This idea was the basis for the construction, in 2019, of this Didactic Gamification Model (DGM).

Objectives

The primary objective of this research was to measure the level of attractiveness among participants for this Didactic Gamification Model (DGM).

A secondary objective of this study aimed to quantify the 2 qualities of this system (pragmatic & hedonic).

Material and methods

The research took place in May 2019 with students participating in a professional training program at "Babeş-Bolyai" University Cluj-Napoca. The DGM was applied on a number of 11 students, aged between 22 and 50 years, 4 male subjects and 7 female subjects.

This model of didactic gamification was built for 6 work units. Each unit of work was designed for two hours, and the teaching activities took place over two consecutive days.

Table 1. The outcomes of DGM

Behavioral outcomes / Psychological outcomes	**Content details**	**Game elements**
Compliance with deadlines	The completion of the received tasks on time is rewarded accordingly. Sending inappropriate material leads to loss of points.	XP
Cooperation	Only the first team to perform the task properly is rewarded. Points and distinctions are received.	XP "Team collaboration" Award (cE)

Behavioral outcomes / Psychological outcomes	**Content details**	**Game elements**
Delight / Joy	Many tasks are built with didactic games integrated on the course content.	XP Awards
Fulfilment	The evolution within the system, depending on the XP accumulated is rewarded with military ranks: Marshal - starting with 1350 XP General - starting with 1200 XP Colonel - starting with 1100 XP Lieutenant Colonel - starting with 900 XP Major - starting with 800 XP Captain - starting at 700 XP Lieutenant - starting at 600 XP Second Lieutenant - starting with 500 XP Sergeant Major - starting with 450 XP Sergeant - starting with 400 XP Corporal - starting with 250 XP Soldier - starting with 100 XP	Military ranks
Increased attention to the requirements of the discipline regarding specific rules for individual tasks	The correct timely submission of individual additional tasks is rewarded. Improper submission of individual additional tasks is sanctioned.	XP (experience points)
Involvement in activities offered	For three physical attendances at the course, a Medal of participation (Mp) is awarded. Two "Mp" medals bring a real point to the final grade.	Medal Real points for final mark
Involvement, commitment, interest in the didactic content	Quick answers are rewarded. The first answer receives points and a distinction. The didactic content made with the team is rewarded.	XP “Quick Response” Award (Rr) XP “Team collaboration” Award (cE)
Participation in activities, involvement, commitment to tasks	Two virtual presences bring a point to the final grade.	Real points for final mark
Participation in the gamified system, use of the gamified system	The registration with your own avatar in the game is awarded. Prolonged attention is rewarded. Two "Rr" distinctions equate to a Medal of Attention for quick answers (Mr). Two "Mr" medals bring a virtual presence but which has the same status as the actual attendances (it counts for access to the final examination, according to the requirements of the discipline). Attendance at the course for each course unit is awarded.	Avatar Medal Virtual attendance at the class XP
Perception of additional benefits	Points are awarded in the final grade for additional individual tasks performed accordingly.	Real points for final mark

Behavioral outcomes / Psychological outcomes	**Content details**	**Game elements**
Perception of one's work	Depending on the military rank a student reaches, he or she has the obligation to analyse the work of colleagues and to offer distinctions to lower military ranks.	Awards
Perception of personal contribution	The corresponding didactic content resolved by teams is rewarded. Points and distinctions are received. For two "cE" distinctions, a Team Collaboration Medal (Me) is awarded. Two "Me" medals bring a virtual presence but which has the same status as the actual attendances (it counts for access to the final examination).	XP "Team collaboration" Award (cE) Medal Virtual attendance at the class
Quantification of personal progress	The points obtained for all game elements are used to compile a ranking, after each course unit.	XP
Quantification of total performance	An updated ranking is used after each course unit. At the end of all course units, the order in the ranking brings points to the final grade.	Real points for tasks
Value of contributions / didactic content achieved	The correct completion of the teaching tasks, for each task, is rewarded with points and distinctions.	XP Awards
Vigilance	Quick answers are rewarded. The first answer receives XP and an "Rr" Award.	XP "Quick Response" Award (Rr)

In order to complete the objectives for this research the User Experience Questionnaire (UEQ), version 7 (08.02.2019), developed by Hinderks, Schrepp & Thomaschewski (UEQ Team, 2018) was applied. Data processing was done with the accessories that UEQ Team offers on their website.

The applied research also included a question, additionally introduced by the author: *How often have you played, digital games, on your computer / phone (strategy games, role-playing games, Angry Birds, Candy Crush Saga, etc.)?* The variants offered were 5 in number, with the following explanations: never, very rarely (several times a year), rarely (once, two or three times a month), often (once, twice a week), very often (every day or at least every second day).

The questionnaire was applied twice, after each group of 3 course units in order to compare the results between the two days of activities but also to see if the students appreciate the applied model differently, between the middle of the period and the final phase. I also wanted to check if there are differences between users who participated at 3 course units only and users who participated at the entire gamified system.

The differences of appreciation of DGM, from the students, between the end of the didactic activity and its first half were verified only for students who participated to all 6 didactic units. They completed a set of questionnaires at the end of the first day, after 3 units and at the end of the second day, after all 6 units. Of the 11 participants, only 5 students participated to all 6 units.

Results

The scores obtained after analysing the attractiveness of the system, along with the other aspects measured by UEQ, can be seen in Chart 1.

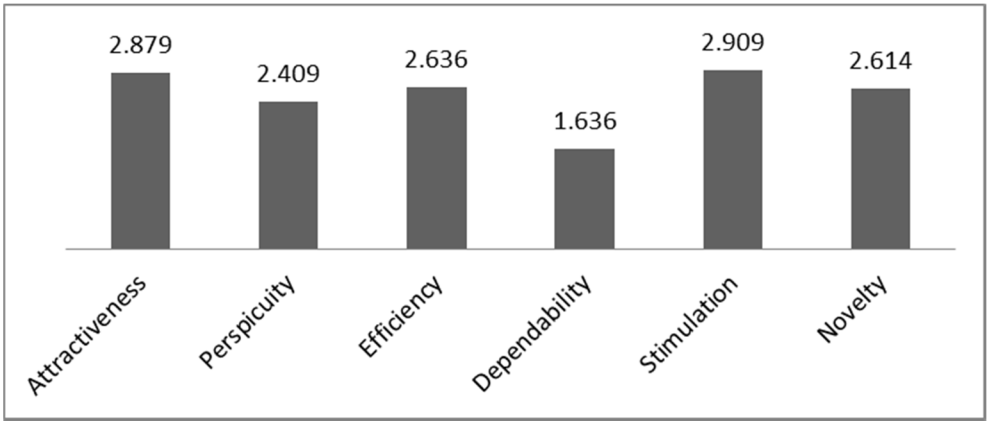

Chart 1. DGM results for all scales (all participants)

The scores of the two qualities of DGM, they are listed in the following Table 2.

Table 2. DGM scores for its two qualities (all participants)

Quality	Points
Pragmatic	2.23
Hedonic	2.76

The results after the first half of the teaching process with DGM can be observed in Chart 2, and in Table 3 you can check the scores for the two qualities of DGM.

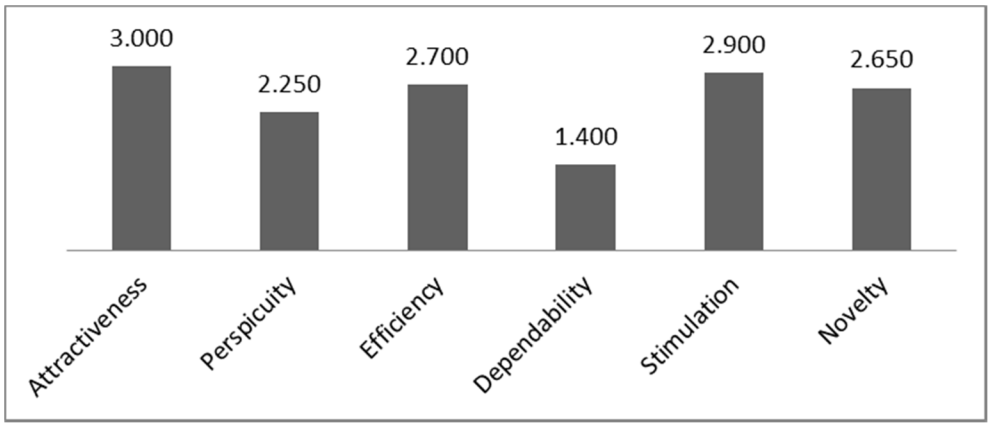

Chart 2. DGM results (after 3 units)

Tabel 3. DGM scores for its two qualities (after 3 units)

Quality	Points
Pragmatic	2.18
Hedonic	2.78

The results of the DGM at the end of the activity can be seen in Chart 3, and the DGM scores for its two qualities are listed in Table 4.

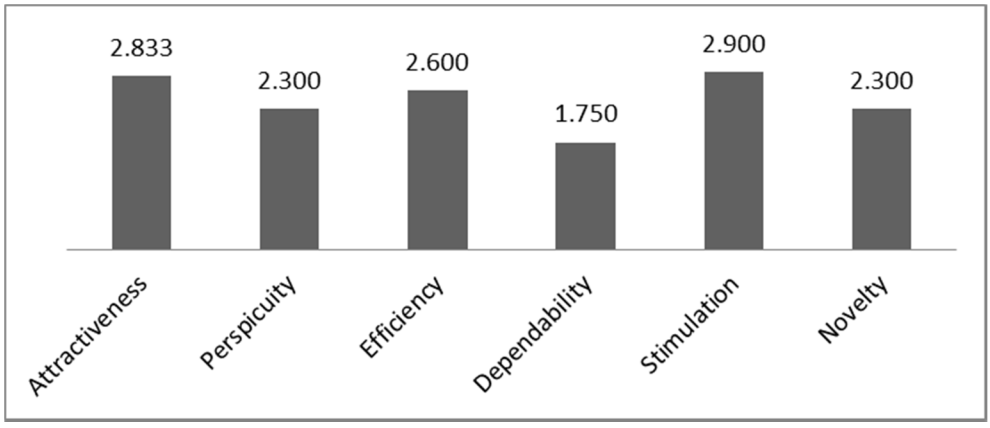

Chart 3. DGM results (after 6 units)

Tabel 4. DGM scores for its two qualities (after 6 units)

Quality	Points
Pragmatic	2.22
Hedonic	2.60

Regarding the reporting of participants in DGM, depending on their degree of familiarity with digital games, two of the 11 students mentioned that they have never enjoyed digital games, 6 stated that they rarely play, and 3 students play often. Therefore, I established two data sets: rare and frequent. The results for the two groups of students can be seen in Chart 4 & Chart 5 and in Table 5 & Table 6.

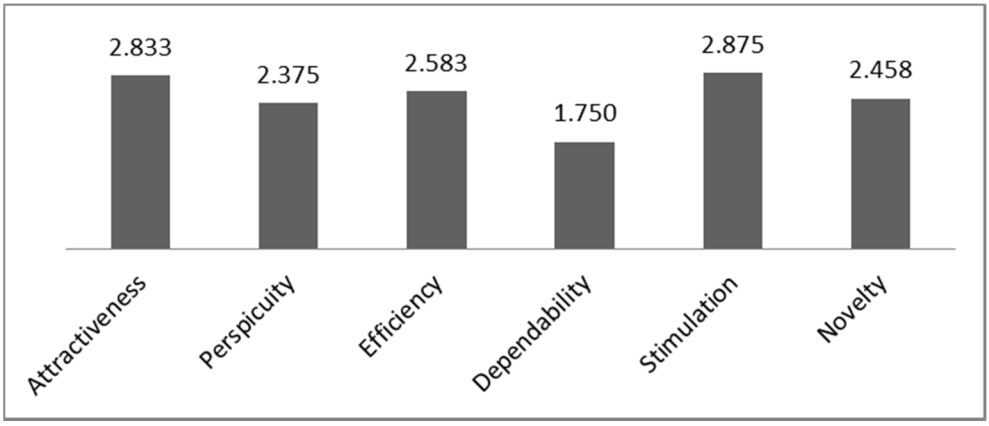

Chart 4. DGM results (participants who rarely use digital games)

Tabel 5. DGM scores for its two qualities
(participants who rarely use digital games)

Quality	Points
Pragmatic	2.24
Hedonic	2.67

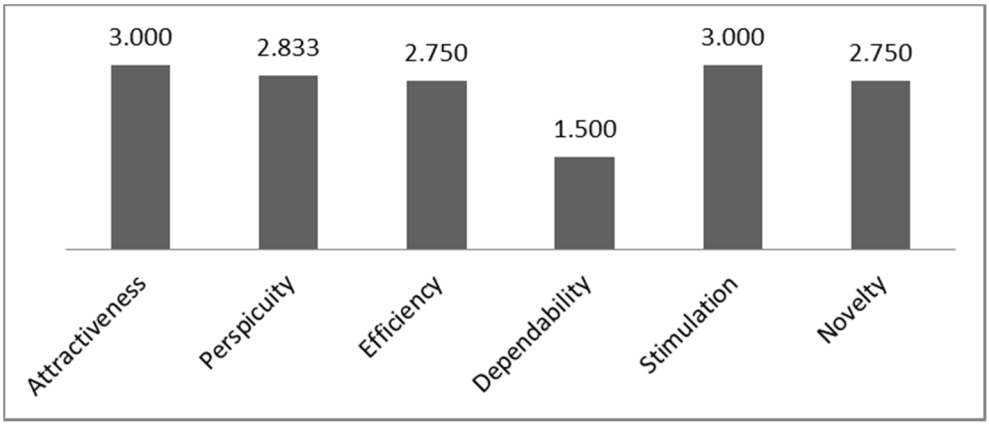

Chart 5. DGM results (participants who often use digital games)

Tabel 6. DGM scores for its two qualities
(participants who often use digital games)

Quality	Points
Pragmatic	2.36
Hedonic	2.88

Discussions

The score obtained by DGM for general attractiveness is very high (close to the maximum value of 3), therefore, it can be stated that the general attractiveness of DGM, perceived by all participants at the end of the teaching program, was very good. This statement is also sustained by a high percentage obtained for hedonic quality. DGM obtained a very good score for hedonic quality, but also a good score for pragmatism. The participants considered that this model of didactic gamification was both useful and pleasant.

For the first half of this teaching process the hedonic quality peaked maximum, recording a slightly lower score at the end. Although it is not a statistically significant difference, it can be attributed to the "novelty effect" that other researchers recall (Koivisto & Hamari, 2019).

For those who often play digital games this DGM presented a high general attractiveness, being more pragmatic and more hedonic than for those who rarely play digital games.

Conclusions

This DGM was highly appreciated by the participants and was rated as valuable on both its qualities: pragmatic and hedonic.

Testing of this DGM was a great opportunity to verify the possibilities of using gamification as efficiently as possible for my future didactic systems.

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ANALYTIC STUDY REGARDING PHYSICAL DEVELOPMENT AND HEALTH LEVEL AT YOUTH POPULATION AGED BETWEEN 10 AND 15 YEARS OLD

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ABSTRACT. Introduction: Health level of youth population has become an increasing problem highlighting that the dysfunction that appears at this age can be a real problem at adult age, so preventing malfunctions at young age can contribute later at adult age. **Objectives:** The present study examined the level of health and development of students that practice sports activities compared with students that don't practice sports, from the Gymnasium School „Friedrich Schiller" from Targu Mures, Romania. The sample of students was formed by 86 students with an average age of 12.80±1.057 from 5th grade until 8th grade. **Methods:** The methods used were mainly from the experiment methods, we used measurement of height, weight and body mass index, and from statistical and mathematical methods for interpretation like descriptive statistics elements (frequency, mean, median, standard deviation) and analyzed with specific statistical test (the D'Agostino & Pearson test, t-Student test, Mann-Whitney test, the Chi-square test) all measured with the GraphPad Prism program. **Results:** The results of the investigation found significant statistical differences between children that practice sports activities compared with those that don't practice sports activities, we found significant statistical differences between weight of the two groups (value of p = 0.236) and also between body mass indexes of groups (value of p = 0.4132). **Conclusions:** Conclusions of the research highlighted the differences of development regarding weight and body mass index of those two groups, proving that children that practice sports activities have a better health and development level.

Key words: anthropometry, body mass index, physical development.

REZUMAT. ***Studiu analitic privind dezvoltarea fizică şi nivelul sănătăţii la populaţia tânără cu vârsta cuprinsă între 10 şi 15 ani.*** **Introducere:** Nivelul de sănătate al populaţiei tinere a devenit o problemă din ce în ce mai mare, subliniind faptul că deficienţele fizice care apar la această vârstă pot fi o problemă

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reală la vârsta adultă, astfel încât prevenirea acestora la vârste fragede poate contribui mai târziu la vârsta adultă. **Obiective:** Prezentul studiu a examinat nivelul de sănătate şi dezvoltare al elevilor care practică activităţi sportive în comparaţie cu elevii care nu practică sport, de la Şcoala Gimnazială „Friedrich Schiller" din Târgu Mureş, România. Eşantionul de elevi a fost format din 86 de elevi cu o vârstă medie de 12,80 ± 1,057, din clasa a V-a până la clasa a VIII-a. **Metode:** Metodele utilizate au fost în principal metode experimentale, am utilizat măsurarea înălţimii, a greutăţii şi a indicelui de masă corporală şi metode statistice şi matematice pentru interpretare ca elemente statistice descriptive (frecvenţă, medie, mediană, abatere standard) şi analizate cu specific test statistic (testul D'Agostino & Pearson, testul t-Student, testul Mann-Whitney, testul Chi-square), toate măsurate cu programul GraphPad Prism. **Rezultate:** Rezultatele prezentului studiu au constatat în compararea și descoperirea unor diferenţe statistice semnificative între copiii care practică activităţi sportive în comparaţie cu cei care nu practică activităţi sportive. Am găsit diferenţe statistice semnificative între greutatea celor două grupuri (valoarea p = 0.236) și, de asemenea, între indicii de masă corporală ai grupurilor (valoarea p = 0.4132). **Concluzii:** Concluziile cercetării au evidenţiat diferenţele de dezvoltare în ceea ce priveşte greutatea şi indicele de masă corporală din cele două grupuri, dovedind că elevii care practică activităţi sportive au un nivel de sănătate şi dezvoltare mai bun.

Cuvinte cheie: antropometrie, indice de masă corporală, dezvoltare fizică.

Introduction

Growth refers to cell multiplication and size changes, while development refers to the maturation of such structures and their concomitant functions. Today we realize that the whole process, in both definitions, is extremely complex and involves a lot of processes that interact with one another (Frank, Martin & Lauren, 2009). Childhood is an important and sensitive period for both physical and cognitive development. There are limited, published research on the relationship between sport and cognitive functions in children. The results suggest that practicing sport in later childhood positively influences cognitive and emotional functions (Ilona, Malgorzata & Carla, 2018).

A recent review of growth and development in children suggests that higher levels of normal physical activity during growth are protective against adiposity, but causality is uncertain because most studies have been transversal (Jillian, Chris & Barbarra, 2017). The World Health Organization (WHO) recommends moderate physical activity of about 30 minutes a day to avoid some cardiovascular problems, obesity or malnutrition (Colin, Chris & Mark, 2010).

Adolescence is a transition between childhood and maturity, whose onset includes puberty maturation. Puberty has important implications for development and many physical, emotional, cognitive and social development issues, including decision-making and mental health (Elizabeth & Ronald, 2009). Growth occurs mainly in quantitative terms and can be monitored by repeated measurements (at fixed intervals) of weight, height, perimeters, diameters, vital capacities, and by multiplying cells, globules (red and white), tissues, capillary and lymphatic vessels and muscle fibers (Dumitru, 2011). Growth standards have been discovered for many populations, and parameters are often coded in a series of growth charts.

This paper will discuss genetic, nutritional, hormonal and physical factors that could modify the growth process (Alan, Pamela & James, 2000). Anthropometry is used to identify subjects requiring special attention or to assess the response of those subjects to any intervention (Alicia, Witriw & Pablo, 2014). Two of the most important indicators of a child's health are their individual growth pattern and their weight in relation to the height, which can be monitored by accurate anthropometric measurements.

Adolescence, between 10 and 19 years of age, begins with the first signs of secondary sexual development and continues until psychological and morphological changes are approaching adulthood to 20 years, during which time there are rapid changes in puberty maturation, growth physical and psychosocial. It is the period of changes with a single significance, with the acquisition of some features and physical defining characters for the adult (Bagiu, 2007).

Metabolism contains the whole set of chemically outcomes that arise in a living organism which permits it to recreate, develop and support its system. Some chemical responses from a challenging network of paths and cycles in whom the stream of reaction products (metabolites) is decided by several adjustment devices. Usually, metabolism is repartitioned into catabolism, sophisticated molecule disintegration, and anabolism, processes tied to the synthesis of elaborate organic materials (Bart, Koen &Jacques, 2009). It is difficult to isolate the specific effects of regular physical activity, health and physical condition, inherent adaptations of growth and development during childhood and adolescence (Andrew, Neil & Timothy, 2007).

A physical condition related to health includes components of the physical condition related to health, including the condition of neuro-mio-arthro-kinetic apparatus, cardiovascular condition, metabolism, and body composition. The important features of the physical condition in relation to health are: body mass related to height (BMI), subcutaneous fat distribution, abdominal visceral adiposity, body composition, bone density, lung and heart function, arterial pressure, maximum aerobic capacity, glucose metabolism and

insulin, the lipid and lipoprotein profile of the glucagon, and the oxidation-related lipid-hydrated ratio (Serbănescu, 2000).

In many situations, many children and adolescents do not follow physical activity recommendations. Evidence also suggests that obese young people are less physically active than those with a normal weight and spend more time in sedentary activities such as computer games, television use and other electronic means (Andrew, Lars & Nuala, 2011). Routine physical activity for all ages is not just an exercise to improve body appearance. In addition to reducing body mass index (BMI) and body weight, regular physical activity is also associated with improving health and is evident from person to person. Various studies have found that day-to-day physical activity among children and young people is associated with improving health (Timothy, Mary & Cindy, 2014). Obesity in adults and children has become a global public health issue.

The definition of obesity is recognized as important in understanding the prevalence of obesity as well as its monitoring and intervention. There are different indices that can obviously put obesity in children and adults. Body Mass Index (BMI) has been used to monitor adult weight and obesity since the 1980s and in children since 1990 (Yi-Fang, Tim & Hui-Qi, 2009).

The formula for the body mass index is calculated with the same method for children and adults, but the interpretation of the meaning of the BMI for youth is different from those used for adults. Therefore, for youth, BMI takes into account the age and gender having specific percentiles used for two reasons: the first reason is that the amount of body fat is in a process of modification with age and the amount of body fat vary from girls to boys (Kuczmarski, 2000). Some scientific papers discovered innovative methods for assessing the percentiles of fat based on only two skin folds (triceps and scapula), which have the purpose to discover the real BMI for children and adolescents Boye, Dimitrou & Manz, 2002).

One common clinical measure of overweight and obesity easily attained with no specialized equipment is body mass index (BMI), this mathematical calculation only requires a participant's mass and height (Walsh, Heazlewood & Climstein, 2018). Body mass index (BMI) is a useful screening tool for overweight and obesity diagnostics in children, adolescents and adults, BMI can be detected quickly and inexpensively (Pontaga & Zidens, 2011). The BMI is calculated by dividing the weight (kg) of a person by the respective height (in m2) (Miller et al., 2003) as follows:

$$BMI = \text{Weight (kg)} / [\text{Height (m)}]2$$

Highly BMI is correlated with enhanced risks for hypertension, atherosclerosis, etc. (Witt & Bush, 2005). BMI provides indication regarding overweight if its value fluctuates from 25 to 29.9 kg/ m2, but obesity can be assessed if BMI is more considerable than 30 kg/ m2 (Mathews & Wagner 2008).

The body mass index depends not only on the fat content in the human body, but as well on the muscles and bones mass, as well as, on the water content in the body of sportsmen. Elevated value of the body mass index can be quantified as overweight in sportspeople with considerable skeletal muscles mass. It indicates that preparation in a lot of sports specialties causes growth of the body mass index (Ode et al., 2007). Although BMI is thought to measure excess weight rather than excess body fat, if appropriate cut-off points are used, a high BMI level is a moderately sensitive and very specific indicator of excess adiposity among children (Freedman et al., 2005).

Design of the Research

Subjects and place of the research

The subjects of the research were represented by 86 students from the "Friedrich Schiller" secondary school in Târgu Mureș. All of these subjects were measured, weighed and examined, the data being passed to the tables.

The investigation period ranged between 15.03.2018 and 01.05.2018.

The main objectives of our study, aimed at pre-school children, were the following: establishing anthropometric indices used in research; the anthropometric measurements; comparing the results of the research with those of the specialized literature; developing graphs and tables to highlight the results of the study.

The hypothesis of the research was following the statistical analysis and interpretation, we will highlight a statistically significant difference between the median values of age, weight and BMI in the two groups, athletes and non-athletes. And also the second hypothesis of the research after using the Chi Square Test, we will have a statistically significant association between the type of class and the practice of the sport, as well as between the two sexes and the practice of the sport.

This investigation was overseen in accordance with the Declaration of Helsinki (2013) and approved by the Ethics Committee before the beginning of the study. It also met the ethical standards for Sport and Exercise Science Research. Due to the fact that the General data protection regulation entered into the appliance on 25 May 2018 (Regulation (EU) 2016/679).

Results

Statistical analysis included descriptive statistics elements (frequency, mean, median, standard deviation) and inferential statistics. The D'Agostino & Pearson test was applied to determine the distribution of the analyzed data series. The Mann-Whitney test, a non-parametric test for unpaired data, was used for comparison of medians. To determine the association between the qualitative variables, the Chi square test was applied. The significance threshold chosen for the p-value was 0.05. Statistical analysis was performed using the Graph Pad Prism.

Table 1. Information regarding students from the fifth grade

No	Class level				Subjects	Age (years)	Gender		Height (cm)	Weight (kg)	BMI	Diabetes				Sports practice		Practiced sports
	V	VI	VII	VIII			M	F				II	I	No	Don't know	Yes	No	
1	1	0	0	0	LA	10	1	0	150	69	30.7	0	0	1	0	0	1	
2	1	0	0	0	RS	12	1	0	150	32	14.2	0	0	1	0	0	1	
3	1	0	0	0	SA	12	1	0	159	70	27.7	0	0	1	0	0	1	
4	1	0	0	0	CA	12	0	1	157	49	19.9	0	0	1	0	1	0	Gymnastics
5	1	0	0	0	CH	11	1	0	157	45	18.3	0	0	1	0	1	0	Tennis
6	1	0	0	0	SG	11	1	0	160	50	19.5	0	0	1	0	0	1	
7	1	0	0	0	BS	11	1	0	144	38	18.3	0	0	1	0	1	0	Tennis
8	1	0	0	0	BD	11	1	0	150	37	16.4	0	0	1	0	1	0	Swimming
9	1	0	0	0	MC	11	1	0	150	34	15.1	0	0	1	0	1	0	Sword fighting
10	1	0	0	0	MA	12	1	0	160	50	19.5	0	0	1	0	1	0	Tennis
11	1	0	0	0	MI	11	1	0	139	30	15.5	0	0	1	0	1	0	Basketball
12	1	0	0	0	PM	12	1	0	164	45	16.7	0	0	1	0	1	0	Volleyball
13	1	0	0	0	HP	11	1	0	149	32	14.4	0	0	1	0	1	0	Football
14	1	0	0	0	VR	11	1	0	139	36	18.6	0	0	1	0	1	0	Football
15	1	0	0	0	DA	12	0	1	160	60	23.4	0	0	1	0	1	0	Swimming
16	1	0	0	0	VA	12	0	1	152	46	19.9	0	0	1	0	1	0	Handball
17	1	0	0	0	MM	12	0	1	167	45	16.1	0	0	1	0	1	0	Athletics

Table 2. Information's regarding students from the sixth grade

No	Class level				Subjects	Age (years)	Gender (M/F)		Height (cm)	Weight (kg)	BMI	Diabetes				Sports practice		Practiced sports
	V	VI	VII	VIII			M	F				II	I	No	Don't know	Yes	No	
1	0	1	0	0	MA	12	0	1	145	32	15.2	0	0	1	0	1	0	Gymnastics
2	0	1	0	0	CM	12	0	1	160	45	17.6	0	0	1	0	1	0	Tennis
3	0	1	0	0	RS	12	0	1	156	45	18.5	0	0	1	0	1	0	Athletics
4	0	1	0	0	CM	13	1	0	158	60	24	0	0	1	0	1	0	Athletics

No	Class level				Subjects	Age (years)	Gender (M/F)		Height (cm)	Weight (kg)	BMI	Diabetes				Sports practice		Practiced sports
	V	VI	VII	VIII			M	F				II	I	No	Don't know	Yes	No	
5	0	1	0	0	IA	13	0	1	162	48	18.3	0	0	1	0	1	0	Tennis
6	0	1	0	0	HI	12	0	1	161	42	16.2	0	0	1	0	1	0	Dance
7	0	1	0	0	PS	13	1	0	161	39	15	0	0	1	0	0	1	
8	0	1	0	0	RR	12	1	0	150	46	20.4	0	0	1	0	1	0	Dance
9	0	1	0	0	CD	12	1	0	162	53	20.2	0	0	1	0	1	0	Swimming
10	0	1	0	0	BD	12	1	0	148	50	22.8	0	0	1	0	0	1	
11	0	1	0	0	BS	12	1	0	177	74	23.6	0	0	1	0	0	1	
12	0	1	0	0	VC	13	1	0	163	47	17.7	0	0	1	0	1	0	Dance
13	0	1	0	0	HR	12	0	1	151	49	21.5	0	0	1	0	1	0	Gymnastics
14	0	1	0	0	PV	12	1	0	154	44	18.6	0	0	1	0	1	0	Football
15	0	1	0	0	DT	12	1	0	168	69	24.4	0	0	1	0	1	0	Fitness
16	0	1	0	0	VI	12	0	1	148	40	18.3	0	0	1	0	1	0	Athletics
17	0	1	0	0	SB	12	0	1	151	41	18	0	0	1	0	1	0	Swimming
18	0	1	0	0	CC	12	0	1	153	38	16.2	0	0	1	0	1	0	Swimming
19	0	1	0	0	IV	13	0	1	154	38	16	0	0	1	0	1	0	Swimming

Table 3. Information's regarding students from the seventh grade

Nr.	Class level				Subjects	Age (years)	Gender (M/F)		Weight (kg)	BMI	Diabetes				Sports practice		Practiced sports
	V	VI	VII	VIII			M	F			II	I	No	Don't know	Yes	No	
1	0	0	1	0	VI	13	0	1	54	19.8	0	0	1	0	1	0	Fitness
2	0	0	1	0	TA	13	0	1	41	14.9	0	0	1	0	0	1	
3	0	0	1	0	CL	13	0	1	40	14.9	0	0	1	0	1	0	Swimming
4	0	0	1	0	HI	13	0	1	47	18.1	0	0	1	0	1	0	Swimming
5	0	0	1	0	TM	13	0	1	42	17.9	0	0	1	0	1	0	Swimming
6	0	0	1	0	BT	13	0	1	67	22.4	0	0	1	0	1	0	Tennis
7	0	0	1	0	HB	14	0	1	63	22.3	0	0	1	0	0	1	
8	0	0	1	0	VA	13	0	1	41	16	0	0	1	0	1	0	Swimming
9	0	0	1	0	BA	13	0	1	41	15.8	0	0	1	0	1	0	Tennis
10	0	0	1	0	RI	13	0	1	38	15.2	0	0	1	0	1	0	Dance
11	0	0	1	0	BM	13	0	1	49	20.4	0	0	1	0	0	1	
12	0	0	1	0	CM	13	0	1	57	17.8	0	0	1	0	0	1	
13	0	0	1	0	BA	14	0	1	80	29.4	0	0	1	0	1	0	Taekwondo
14	0	0	1	0	SL	13	0	1	44	18.8	0	0	1	0	0	1	
15	0	0	1	0	SI	13	0	1	57	22.5	0	0	1	0	1	0	Dance
16	0	0	1	0	GD	14	0	1	57	23.4	0	0	1	0	0	1	
17	0	0	1	0	BC	13	0	1	53	19.9	0	0	1	0	0	1	
18	0	0	1	0	BA	14	0	1	47	17.7	0	0	1	0	0	1	
19	0	0	1	0	SR	13	1	0	40	18	0	0	1	0	1	0	Football

Nr.	Class level				Subjects	Age (years)	Gender (M/F)		Weight (kg)	BMI	Diabetes				Sports practice		Practiced sports
	V	VI	VII	VIII			M	F			II	I	No	Don't know	Yes	No	
20	0	0	1	0	GM	13	1	0	49	19.6	0	0	1	0	1	0	Basketball
21	0	0	1	0	OR	12	1	0	52	19.6	0	0	1	0	1	0	Carting
22	0	0	1	0	CU	14	1	0	40	13.2	0	0	1	0	1	0	Basketball
23	0	0	1	0	GC	14	1	0	54	17.8	0	0	1	0	1	0	Tennis
24	0	0	1	0	CR	13	1	0	50	17.9	0	0	1	0	1	0	Basketball
25	0	0	1	0	MV	13	1	0	67	21.1	0	0	1	0	1	0	Basketball
26	0	0	1	0	OA	13	1	0	85	26.5	0	0	1	0	1	0	Basketball
27	0	0	1	0	BA	13	1	0	77	23.8	0	0	1	0	1	0	Swimming
28	0	0	1	0	LR	13	1	0	60	25.6	0	0	1	0	1	0	Tennis
29	0	0	1	0	CA	13	1	0	50	18.8	0	0	1	0	1	0	Football

Table 4. Information's regarding the eighth-grade students

No	Class level				Subjects	Age (years)	Gender (M / F)		Height (cm)	Weight (kg)	BMI	Diabetes				Practice sports		Sports practiced
	V	VI	VII	VIII			M	F				II	I	No	Don't know	Yes	No	
1	0	0	0	1	GA	14	1	0	165	56	20.6	0	0	1	0	0	1	0
2	0	0	0	1	VD	14	1	0	169	60	21	0	0	1	0	0	1	0
3	0	0	0	1	ML	14	1	0	177	59	18.8	0	0	1	0	1	0	Tennis
4	0	0	0	1	OP	14	1	0	167	47	16.9	0	0	1	0	0	1	0
5	0	0	0	1	RA	14	1	0	179	72	22.5	0	0	1	0	1	0	Football
6	0	0	0	1	CR	14	1	0	165	51	18.7	0	0	1	0	1	0	Football
7	0	0	0	1	MP	14	1	0	165	47	17.3	0	0	1	0	1	0	Football
8	0	0	0	1	SS	14	1	0	163	45	16.9	0	0	1	0	0	1	0
9	0	0	0	1	LR	14	1	0	166	45	16.3	0	0	1	0	0	1	0
10	0	0	0	1	OS	15	0	1	167	62	22.2	0	0	1	0	1	0	Water polo
11	0	0	0	1	LO	15	0	1	160	48	18.8	0	0	1	0	1	0	Basketball
12	0	0	0	1	VO	14	0	1	166	50	18.1	0	0	1	0	1	0	Basketball
13	0	0	0	1	BA	14	1	0	162	54	20.6	0	0	1	0	0	1	0
14	0	0	0	1	MD	14	0	1	166	56	20.3	0	0	1	0	1	0	Handball
15	0	0	0	1	SB	14	0	1	166	53	19.2	0	0	1	0	0	1	0
16	0	0	0	1	CD	14	0	1	168	56	19.8	0	0	1	0	1	0	Dance
17	0	0	0	1	RT	15	0	1	174	63	20.8	0	0	1	0	1	0	Swimming
18	0	0	0	1	SA	14	0	1	166	64	23.2	0	0	1	0	1	0	Tennis
19	0	0	0	1	BI	14	0	1	166	63	22.9	0	0	1	0	1	0	Table tennis
20	0	0	0	1	FS	14	0	1	156	83	34.1	0	0	1	0	0	1	0
21	0	0	0	1	MN	14	0	1	166	100	36.3	0	0	1	0	1	0	Fitness
22	0	0	0	1	IO	14	0	1	169	75	26.3	0	0	1	0	1	0	Swimming

Table 5. Statistical interpretation of the data

Statistical parameters	Practice sport (64) Mean ± SD (Median)	Doesn't practice sport (23) Mean ± SD (Median)	Value of p
Age	12.80±1.057 (13.00)	13.09±1.125 (13.00)	*0.1445
Weight	51.27±13.67 (48.50)	53.83±11.98 (53.00)	*0.2361
BMI	19.58±3.876 (18.65)	20.62±4.923 (19.90)	*0.4132

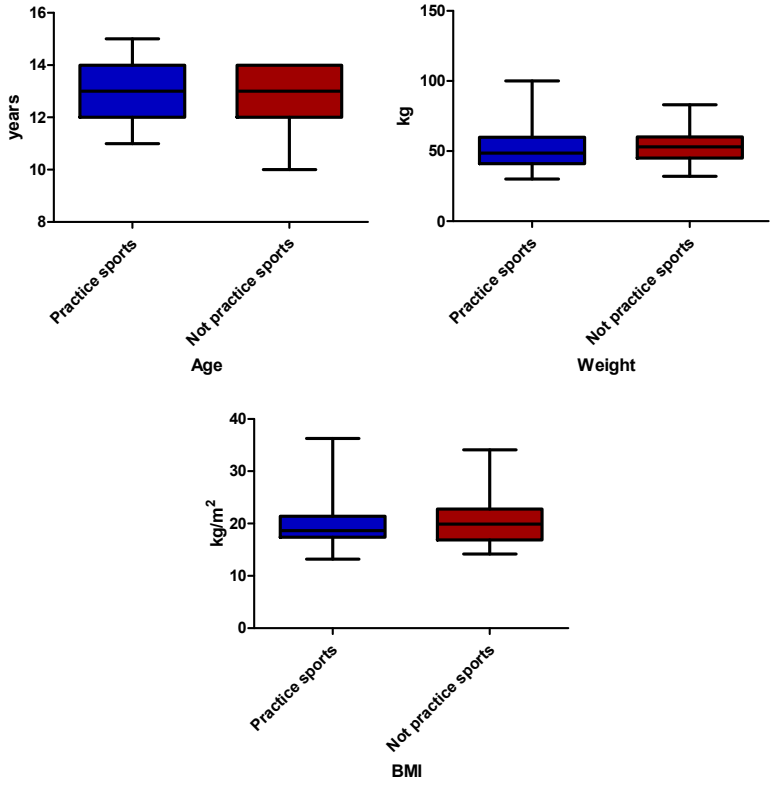

Figure 1. Statistical interpretation regarding age, weight and BMI

In Table 5 and Figure 1, we used the Mann-Whitney test, with a value of significance of $p<0.05$, and found that there is a statistically significant difference between the median of age values for the 2 groups.

Also, in Table 5 and Figure 1, the second step was measuring with the Mann-Whitney test, with a value of significance of $p<0.05$, we discovered that there is a statistically significant difference between the mean values of weight in the 2 groups.

The last step using the Mann-Whitney test, with a value of significance of $p<0.05$, we observed that there is a statistically significant difference between the median BMI values for the 2 groups, the results were also highlighted in Table 5 and Figure 1.

Table 6. Statistics regarding children that practice sport and those that doesn't practice sports

Parameters		Practice sport (64)	Doesn't practice sport (23)	Value of p
Grade	V	13	4	0.5095
	VI	16	3	
	VII	21	8	
	VIII	14	8	
Gender	Female	34	10	0.5820
	Male	30	13	

Discussions

As a result of the measurements made on the 4 classes of students from the gymnasium cycle, we found that girls performing moderate physical activity have a height relative to optimal weight, in other words, a lower BMI than those who do not practice physical activity on a regular basis.

For the fifth grade, we centralized the following results: 152.5 cm height for females, 153.3 cm height for males, weight 50 kg for females, 43.6 for males, 19.2 Body mass index for females and 19 for males. Students that practice sport: 4 females and 9 males.

In relation to the sixth grade, we found: 153.8 cm height for females, 160 cm height for males, weight 41.8 kg for females, 53.5 for males, 17.6 Body mass index for females and 20.7 for males. Students that practice sport: 10 females and 6 males.

In the seventh grade, the results were: 171. 8 cm height for females, 167 cm height males, weight 54 kg for females, 56.7 for males, 19.2 Body mass index for females and 20.1 for males. Students that practice sport: 11 females and 10 males.

In terms of the eighth grade: 165.8 cm height for females, 167.8 cm height males, weight 64.4 kg for females, 53.6 for males, 23.5 Body mass index for females and 18.9 for males. Students that practice sports: 10 females and 8 males.

Physical activity and sports practice through recreation period have been provided as an effective component to achieve an individual and social improvement (Comez-Marmol et al., 2017), because of the favorable concept society has about them and as well due to its appeal and its possible capability to convene, particularly between adolescents (Escarti, Gutiérrez, Pascual, & Marín, 2010; Ginesta, 2007; Menéndez & Fernández-Río, 2016).

A study similar to ours, conducted by Andy R. Ness, Sam D Leary, Calum Mattock, and Steven N Blair, Objectively Measured Physical Activity and Fat Mass in a Large Cohort of Children, attempts to highlight the importance of physical activity within a group of about 5,000 children aged 12 years old. In the above study, a cross-sectional analysis was performed on 5,500 12-year-olds enrolled in the Avon Parents and Children study. Total physical activity and moderate and vigorous physical activity minutes (MVPA) were measured using the Actigraph accelerometer. Fat weight and obesity were measured using the Prodigy lunar emission dual-beam absorption scanner. Strong negative associations between MVPA and fat mass were found which were unchanged after adjustment for total physical activity. They found a strong negative association between dose response and MVPA and obesity.

Previous studies have not been able to characterize the association between physical activity and obesity, probably because most were based on inaccurate measurements of physical activity and obesity. Finally, we can say that physical activity plays an essential role in a child's physical health. Also, other studies discovered that overweight BMI and obesity conducts to flattening of the thoracic kyphosis and increasing lumbar lordosis (Grabara & Pstragowska, 2008). Thus, lordosis was observed to develop in numerous cases of overweight or obese people due to the protruding stomach. As can be observed, the spine keeps the body strait and through this it develops arch at the lower back to hold the body strait (Wyszyńska et al., 2016).

It has been suggested that fat mass may be the cause of the outward appearance of a "flat" foot in obese individuals (Wearing et al., 2012).

As we can observe other studies focused their attention on varum knee deficiencies proving that BMI is a big factor causing this dysfunction affirming that nowadays, the effect of high levels of BMI on knee alignment has gone trialled on adolescence population, and the larger the valgum dysfunction was remarked among obese adolescence in late puberty (Boye et al., 2002; Taylor et al., 2006).

Scientists have discovered that behavioral factors correlated with overweight and obesity among youngsters also feature insufficient physical activity (Eaton et al., 2010; Troiano et al., 2008), extreme sedentary period, such as screen time (Costigan et al., 2013), and unhealthful eating tendencies, covering drinking sweet beverages (Welsh, Sharma, Cunningham, & Vos, 2011), consuming fried snacks at or from a fast food spot (Andreyeva et al., 2011), and not consuming regular breakfast (Haug et al., 2009).

In recent scientific papers was found that involvement of adolescents in sports activities has much less influence on motor abilities than that of natural biological growth and maturation, compared with those that did not train, boys who train for a sport had significantly better results only in 2 motor tests, which

were confirmed by factor analysis to be valid tests of coordination, these results suggest that the morphological status of 13-year-old children better predict coordination performance than speed performance (Lazarevic et al., 2011).

Regularly monitoring of body composition in sport is an important indicator of health and physical development in adolescent athletes (Matus & Cech, 2018), such as identification of eating disorders, overtraining, disease or to compare body composition with sports performance. Rating of body constructor is also part of identification, selection and development of young talented athletes (Malina & Beunen, 2008), such as identifying the basic elements in body composition for the needs of sport. In young athletes the level of BMI and fat mass lower than common population, what is given especially the type of practiced sport (Strong, 2005).

Some scientific papers discovered innovative methods for assessing the percentiles of fat based on only two skin folds (triceps and scapula), which have the purpose to discover the real BMI for children and adolescents (Boye et al., 2002). Also other scientific papers discovered a significant relationship between the body mass index in the football players and the lean body mass that was explained by growth of the skeletal muscles mass and also found a significant relationship was detected between the body mass index and the fat content in the body, therefore the increased value of BMI also depends on the greater content of fat tissue in the body (Potanga & Zidens, 2011).

Conclusions

After researching and interpreting the results, we came to confirm the hypothesis that: girls who practice sport in an organized way have a lower body mass index than those who do not practice a particular sport.

Also hypothesis number one was confirmed, and following the analysis and statistical interpretation we highlighted a statistically significant difference between the median values of age, weight and BMI in the two groups, athletes and non-athletes.

The second hypothesis was infirmed, and after using the Chi Square Test we did not have a statistically significant association between the type of class and playing sports, as well as between the two genders and playing sports.

Anthropometric indices have a value closest to normal in girls who have an increased physical activity. As a result of the study of the four gymnasium classes, we came to the conclusion that girls with intense physical activity have a lower body mass index than those who are sedentary, more optimal weight and higher physical strength.

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DEFINING A MUTUAL RELATIONSHIP AMONG THE BODY POSTURE, PHYSICAL CONDITION (FITNESS) AND REGULAR PHYSICAL ACTIVITY IN CHILDREN OF YOUNG SCHOOL-AGE

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ABSTRACT. Introduction. The main focus of our study was to evaluate the body posture in a group of 147 children aged 6.4 – 9.8 y. In the study, we tried to find a statistically significant relationship among a body posture, particular components of physical fitness and the amount of physical activity. **Methods.** To evaluate the body posture, a modified Matthias test was used. To test the physical fitness, the UNIFITTEST 6-60 was used, including defining the somatotypes and it´s specific features. To find out the amount of physical activity, a questionnaire was used, which was completed by parents due to the age of the respondents. **Results.** The results have shown disbalances in body posture in the observed group of young school-age children. In total 53.1 % of children of the monitored group had poor body posture. Based on the t-test, statistically significant difference in the evaluation of the quality of body posture was found between the groups of boys and girls ($t=3.21$; $p<0.01$), boys scored worse in the body posture test. Only a feeble correlation between the quality of the body posture and the amount of organized physical activity was measured in the group of girls ($r_s = -0.24$; $p<0.05$) – girls with a higher volume of extracurricular physical activities had better results in the evaluation of posture; however, this effect was small. The study has not shown any relations between the body posture and the individual components of physical fitness. The quality of the body posture is neither related to the amount of subcutaneous fat nor the BMI. Those children who practice some organized physical activity less frequently did worse in most tests concerning physical endurance. Their amount of subcutaneous fat was higher than in children who often participate in various after school activities more. The results of tests of fitness in both groups of girls and boys are even, the only statistically significant difference between these groups was found in the test result of the maximum reach while sitting, boys scored worse in this test ($Z=-2{,}686$; $p < 0.01$). **Conclusion.** More than half of the children of young school-age in the observed group children had poor body posture or at leas some posture deviation, the boys had a worse posture than the girls. The results of our research did not show a relationship between

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posture and performance in physical fitness tests. There was no evidence of a relation between body posture and body composition (measured by amount of subcutaneous fat and BMI). Sufficient physical activity probably has a positive effect on increasing fitness, but the relationship to posture is inconclusive.

Keywords: *body posture, physical activity, body fitness, young school-age children.*

Introduction

A typical feature of today´s lifestyle is a lack of diverse physical activity on one hand and the asymmetrical, typically static activities and overstraining on the other hand which may lead to permanent changes in the body´s motive system. These negative changes cause a lower level of physical fitness, lower muscular activity and may result in disbalances in body posture already in preschool-aged children. The situation gets even worse once children enter school (Kratěnová, Žejglicová, Malý & Filipová, 2007; Murphy, Buckle & Stubbs, 2004). Sixty percent of free time spent by active movement is considered a sufficient amount of physical activity in young school-aged children. The level of physical activity in today´s Czech children covers only about 60-70% of the desired amount (Bunc, 2005; Miklánková, Elfmark & Sigmund, 2013; Sigmund, Sigmundová & Ansari, 2009; Hálková & Ryklová, 2009). However, there are many children who suffer from an excessive amount of physical activity which is often one-sided, performed badly and in a non-compensatory way (Perič, 2010; Grabara, 2012). Fast biological growth, which appears in the period of young school-age children, alongside the lack of physical activity and bad movement habits make the situation in body postures even worse and may result in various orthopaedic issues (Hnízdil, Šavlík & Beránková, 2005; Novotná & Kohlíková, 2000; Mužík, Forejt, Matějová, Mužíková, Gottvaldová, Hlavatá & Škaloudová, 2007; Molina-Garcia, Plaza-Florido, Mora-Gonzalez, Torres-Lopez, Vanrenterghem, J. & Ortega, 2020; Noll, Candotti, Rosa & Loss, 2016).

Not treating ~~a~~ poor body posture in childhood may result in degenerative changes in the skeletal system especially in the spinal area in adulthood, which may be very painful. There are many studies that indicate that about 80% of children and teenagers suffer from ~~a~~ poor body posture. If we take into consideration even minor disbalances in the body posture, we will barely find a child whose body movement system and body posture would be ideal (Bunc, 2005; Kolisko, 2003; Kopecký, 2010; Brackley, Stevenson & Selinger, 2009; Wyszyńska, Podgórska-Bednarz, J., Drzał-Grabiec, J., Rachwał, M., Baran, J., Czenczek-Lewandowska, E., ... & Mazur, 2016).

A sufficient amount of physical activity together with an improvement of physical fitness should then have a positive effect on the quality of the body posture and should prevent children from changes in their posture. However, the results from various studies on this matter differ significantly. All the studies have shown a very important number of children with ~~a~~ poor body posture, which gets even worse with age, but do not agree on the correlation between the amount of physical activity and the occurrence of poor body posture. For example, the studies conducted by Riegerová & Ulbrichová, 1993 or Kratěnová et. al. (2007) indicate that physically active children don´t suffer from poor body posture as frequently. However, studies conducted by Vrbas (2010) or Bunc (2005) showed that the amount of physical activity or one´s fitness have only little effect on the occurrence of a poor body posture.

Studies in younger children concerned mostly subjects with some health problems and deterioration, but few researches were focused on growth changes and body posture in normal population. This study focuses on the quality of body posture, tries to state the level of physical fitness and the amount of physical activity or inactivity in children, and tries to find any possible relation between these quantities. The results should help us define whether a sufficient amount of physical activity and a certain level of physical fitness can be used as preventive measures to avoid poor body posture.

The aim of the study

The study tries to find any significant correlation between a body posture and anthropometric factors, areas of physical fitness and the amount of organized physical activity as well as among all the variables.

Methodology

The specifics of the researched sample

The sample consisted of children in 1st -3rd grade from Na Výsluní Elementary School in Brandýs nad Labem, Czech Republic. The pupils involved in the study were selected based on the informed consent of parents. The selection made was intentional. 178 parents gave consent to include their child in the study, however, complete results were collected from 147 children, 77 boys and 70 girls aged 6.4-9.8. The remaining children did not complet the whole testing (due to illnesses, injuries, incapability of completing given tasks, etc.)

Table 1. Basic characteristics of the sample

		Frequency	Percent
Valid	Boys	77	52.4
	Girls	70	47.6
	Total	147	100.0

Research methods

Body posture evaluation

To evaluate the quality of body posture, the Matthias´s test was used (upright standing position for 30 seconds). The assessment scale was modified to be able to evaluate the quantitative results effectively. On a 3-point scale, 3 specific segments were assessed: position of the head and cervical spine; position of the upper limbs; the form of thorax and shoulder blades; the dorsal curvature; the back symmetry in the frontal plane (to specify the segments, other particular tests were used – Klein, Thomas and Mayer and Jaroš and Lomíček´s test). A picture was taken at the beginning and at the end of the test. Thus, it was possible to depict even the smallest deviations in body posture, which would be difficult to observe with the naked eye. At the beginning and at the end of the test, the body posture was assessed by points. Both sets of points were added to get the final results. For further analysis of potential mutual correlations, the results were left intact. To make the data easier to evaluate, the results of the body posture in the sample group were divided into subgroups as follows: excellent, satisfactory, poor, very poor (unsatisfactory) body posture.

Table 2. Statistical data for basic parameters

	N			Std.				Percentiles	
	Valid	Mean	Median	Deviation	Range	Minimum	Maximum	25	75
Age	147	8.0329	8.0794	0.68470	3.45	6.31	9.76	7.5975	8.5092
Height [cm]	147	131.426	131.800	6.6614	43.0	112.3	155.3	126.900	136.100
Weight [kg]	147	28.723	27.300	6.3294	40.4	19.7	60.1	24.700	31.100
BMI percentil	147	53.37	51.00	27.916	100	0	100	31.00	80.00
Fat	147	25.88	22.00	15.042	74	6	80	16.00	33.00
Body posture	147	18.78	19.00	3.476	17	10	27	16.00	21.00

	N			Std.				Percentiles	
	Valid	Mean	Median	Deviation	Range	Minimum	Maximum	25	75
Physical activity	147	144.18	135.00	101.126	420	0	420	60.00	225.00
Passive entertainment	147	303.23	300.00	217.577	1200	0	1200	150.00	450.00
Shuttle run [s]	147	15.3262	15.0800	1.76280	8.71	11.97	20.68	13.9300	16.4500
Standing broad jump [cm]	147	123.33	121.00	17.971	91	82	173	111.00	137.00
1000 m run [s]	147	381.733	378.100	96.3777	1006.6	253.4	1260.0	330.400	413.100
Sit-ups	147	26.38	26.00	9.635	51	0	51	21.00	33.00
Reach while sitting [cm]	147	2.35	3.00	7.687	40	-20	20	-1.00	8.00

Physical fitness evaluation (assessment)

The assessment of physical fitness was based on a standardized UNIFITTEST 6-60. Values of somatic features (such as height, weight, subcutaneous fat, BMI index) were measured. Standing jump test, shuttle run and sit-ups were used as such, the endurance test was modified to a 1000m run due to the limited possibilities of the facilities used. A test of maximum reach while sitting bended was used to measure flexibility, or to test how much the back thigh muscles and lumbar muscles shortened, which in the standard Unifittest is used for a group of 25 + year-olds.

Evaluation of the amount of physical activity

A simple questionnaire was set up to serve the needs of the research. It assessed the volume and type of organized physical activity and the amount of passive entertainment (tablet, PC, smartphone) during a regular working week. Due to the age of the respondents, the questionnaire was completed by their parents. To serve the needs of correlation analysis, the data in gross score were used.

Statistical methods

The standard statistical characteristics corresponding to the types of variables were used. The importance of the differences between a group of girls and boys and between the groups of younger and older school-aged

children was verified by using a t-test with parametrical data and the Mann-Whitney test with non-parametrical data. To analyze the dependency of variables a Spearman´s rank correlation coefficient was used. The correlations between specific components of physical fitness were tested first, then the correlations between body posture and components of physical fitness compared to the amount of physical activity and passive entertainment (p-value is at the 0.01 level or at 0.05 level).

Results of the research

Basic description

The assumption of a regular distribution was tested by the Shapiro-Wilk test, the conditions given applies to the body height, body posture, sit-ups and standing broad jump. All the remaining variables show other than regular data distribution.

Statistically important differences appeared in body posture ($t=3.21$; $p<0.01$) and reach while sitting test ($Z=-2,686$; $p < 0.01$) between the groups of girls and boys. Boys score worse in both tests. In further analysis of correlations with the given parametres, these two groups were assessed separately. The remaining variables were assessed as a whole set of data.

The number of children with a poor body posture is significant. Excellent or satisfactory body posture was observed in less than half of the sample.

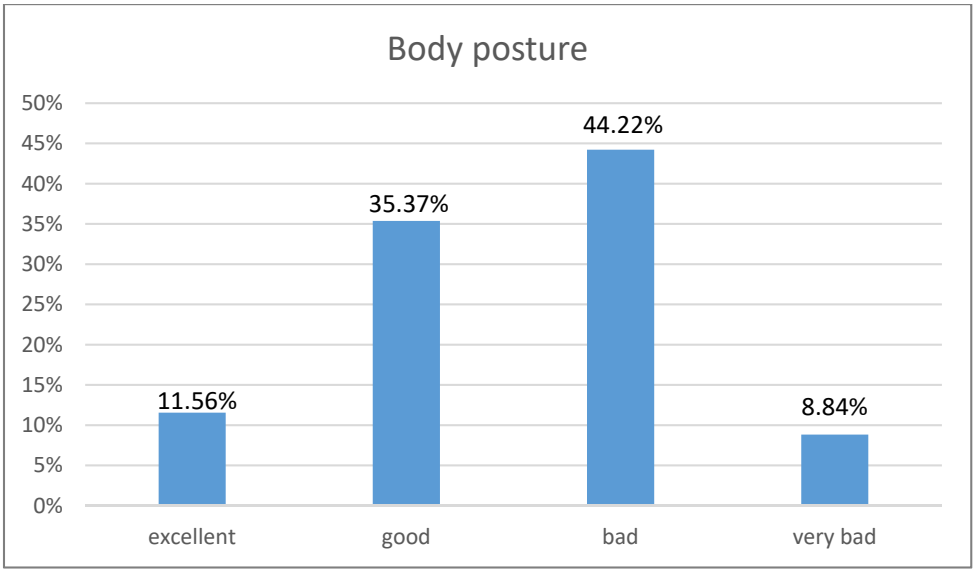

Figure 1. Body posture of the sample

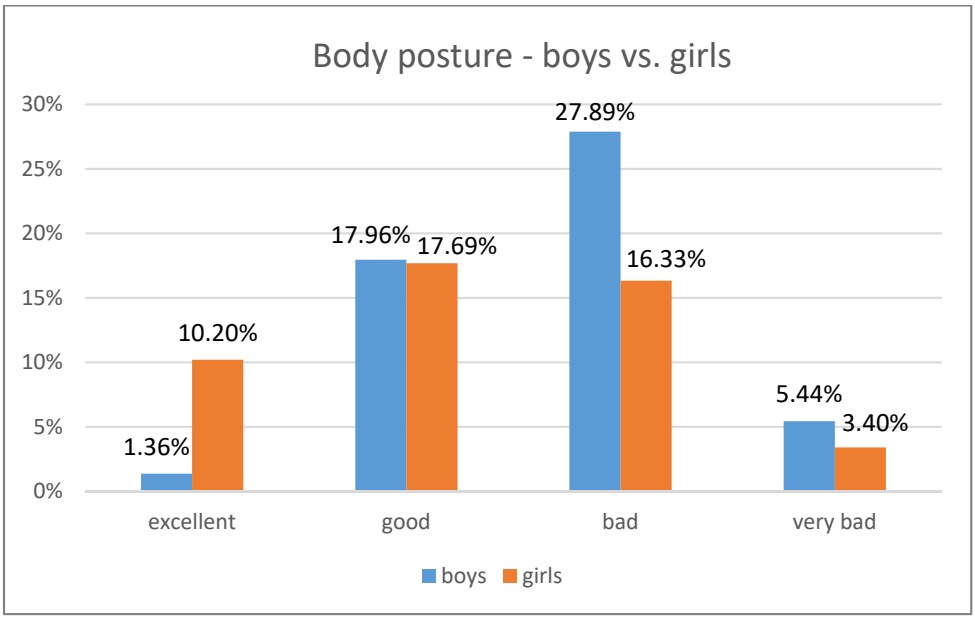

Figure 2. Gender differences in body posture

Results of correlation analysis

The figures of correlations between BMI index, height, age and body weight show a logical and expected relationship between the BMI index, body weight and the amount of subcutaneous fat. There is also a slight correlation between the body height and subcutaneous fat, thus in older and taller children a higher amount of the subcutaneous fat was measured.

Table 3. Correlation of data

Correlation			BMI percentil	Fat
Spearman's rho	Age	Correlation Coefficient	0.137	**0.176***
		p-value	0.097	0.033
	Height [cm]	Correlation Coefficient	**0.324****	**0.236****
		p-value	0.000	0.004
	Weight [kg]	Correlation Coefficient	**0.804****	**0.528****
		p-value	0.000	0.000
	BMI percentil	Correlation Coefficient		**0.625****
		p-value		0.000
**. Correlation is significant at the 0.01 level (2-tailed).				
*. Correlation is significant at the 0.05 level (2-tailed).				

Overall performance of children in physical fitness tests showed mutual dependence in most components of the physical fitness. There is a clear connection in performance in the shuttle run, standing jump, endurance run and sit-ups (good results in one test mostly showed also good results in another). However, the correlations measured were rather weak. The scores in reach test while sitting showed a certain connection with the standing broad jump test in both girls and boys, while weak dependence in the sit-ups test and shuttle run was measured in boys only (Table 4).

Table 4. Correlation between between components of the physical fitness

Correlation		Standing jump	1000 m run	Sit-ups	Reach while sitting - boys	Reach while sitting - girls
Shuttle run	Correlation Coefficient	**-0.355****	**-0.242***	-0.097	**-0.242***	-0.097
	p-value	0.000	0.034	0.426	0.034	0.426
	N	147	147	147	77	70
Standing broad jump	Correlation Coefficient		**0.233***	**0.351****	**0.233***	**0.351****
	p-value		0.042	0.003	0.042	0.003
	N		147	147	77	70
1000 m run	Correlation Coefficient			**0.225***	-0.170	-0.059
	p-value			0.049	0.139	0.627
	N			147	77	70
Sit-ups	Correlation Coefficient				**0.225***	0.071
	p-value				0.049	0.560
	N				77	70
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

The amount of subcutaneous fat influences negatively almost all components of physical fitness. The extent of dependence, however, is rather small, the strongest relation measured was between the amount of subcutaneous fat and the endurance. No dependence was shown between the body fat and flexibility (reach while sitting).

The extent of correlation between BMI index and individual components of the physical fitness test showed only a small negative relation between BMI index and the performance in a 1000-m run – the higher the BMI index, the poorer performance in the run test.

In a group of boys, a small negative correlation was measured between the reach while sitting test and the body height – taller boys did worse in the test.

Table 5. Correlation between individual components of the physical fitness test and the body posture

Correlation			Shuttle run	Standing jump	1000 m run	Sit-ups	Reach while sitting – boys	Reach while sitting - girls
Spearman's rho	Age	Correlation Coefficient	0.216	-0.010	-0.041	0.134	-0.155	-0.205
		p-value	0.077	0.909	0.619	0.106	0.179	0.088
		N	147	147	147	147	77	70
	Height	Correlation Coefficient	-0.150	0.100	0.014	0.164	**-0.225***	-0.196
		p-value	0.069	0.229	0.868	0.088	0.049	0.103
		N	147	147	147	147	77	70
	Weight	Correlation Coefficient	-0.075	-0.022	.117	0.095	-0.111	-0.108
		p-value	0.367	0.787	0.159	0.252	0.338	0.375
		N	147	147	147	147	77	70
	BMI percentil	Correlation Coefficient	0.005	-0.159	**0.211***	-0.036	-0.047	0.023
		p-value	0.955	0.054	0.010	0.662	0.688	0.848
		N	147	147	147	147	77	70
	Fat	Correlation Coefficient	**0.281****	**-0.346****	**0.388****	**-0.280****	-0.185	-0.225
		p-value	0.001	0.000	0.000	0.001	0.107	0.062
		N	147	147	147	147	77	70
**. Correlation is significant at the 0.01 level (2-tailed).								
*. Correlation is significant at the 0.05 level (2-tailed).								

No significant relation appeared between individual components of the physical fitness test and the body posture.

However, certain relations between the amount of physical activity and particular components of the physical fitness were found. A slight positive dependence proved in shuttle run test and standing broad jump (more physical activity meant better results), the strongest relation appeared between the amount of physical activity and the results in a 1000-m run.

A small positive relation between the body posture and the amount of organized physical activity appeared in a group of girls.

The amount of physical activity negatively correlates with the amount of body fat – the more afterschool activities children have, the smaller amount of the body fat they have.

The amount of passive entertainment did not show any significant relationship with any other parameter measured.

Table 6. Correlation between the amount of physical activity and particular components of the physical fitness

Correlation			Physical activity	Passive entertainment	Body posture BOYS	Body posture - GIRLS
Spearman's rho	Age	Correlation Coefficient	-0.082	-0.019	0.092	0.141
		p-value	0.324	0.824	0.428	0.245
		N	147	147	77	70
	Height	Correlation Coefficient	0.009	-0.107	0.005	-0.117
		p-value	0.916	0.196	0.967	0.197
		N	147	147	77	70
	Weight	Correlation Coefficient	-0.019	-0.040	-0.093	-0.228
		P-value	0.819	0.629	0.422	0.057
		N	147	147	77	70
	BMI percentil	Correlation Coefficient	-0.091	0.033	-0.073	-0.035
		p-value	0.274	0.668	0.527	0.775
		N	147	147	77	70
	Fat	Correlation Coefficient	**-0.231****	-0.022	0.019	0.116
		p-value	0.005	0.793	0.871	0.340
		N	147	147	77	70
	Shuttle run	Correlation Coefficient	**-0.164***	0.035	-0.067	.173
		p-value	0.048	0.677	0.564	0.122
		N	147	147	77	70
	Standing broad jump	Correlation Coefficient	**0.207***	-0.040	-0.056	0.104
		p-value	0.012	0.634	0.627	0.393
		N	147	147	77	70
	1000 m run	Correlation Coefficient	**-0.344****	0.119	-0.026	0.235
		p-value	0.000	0.150	0.821	0.050
		N	147	147	77	70
	Sit-ups	Correlation Coefficient	0.090	-0.029	-0.045	-0.184
		p-value	0.276	0.725	0.695	0.126
		N	147	147	77	70
	Reach while sitting - boys	Correlation Coefficient	0.136	0.002	-0.106	
		p-value	0.239	0.989	0.357	
		N	77	77	77	
	Reach while sitting - girls	Correlation Coefficient	-0.001	0.075	0,123	-0.184
		p-value	0.995	0.537	0.311	0.126
		N	70	70	77	70
	Physical activity	Correlation Coefficient		-0.009	-0.097	**-0.240***
		p-value		0.913	0.401	0.045
		N		147	77	70
	Passive entertainment	Correlation Coefficient			0.043	-0.161
		p-value			0.707	0.183
		N			77	70

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Conclusions

An appropriate body posture is an important factor for the body to function effectively. Deviations from the correct body posture may result in serious health issues. The foundations and appropriate habits for a proper body posture are laid in childhood. It is also the moment when any possible deviations may be diagnosed and fixed. That is why it is so important to observe closely this age group.

The study has not shown any relations between the body posture and the individual components of physical fitness.

Based on the results of our study, the quality of the body posture is neither related to the performance in physical fitness tests nor to the amount of the passive entertainment, nor the amount of the organized physical activity. Only a feeble correlation between the quality of the body posture and the amount of the organized physical activity was measured in the group of girls, while boys have not showed such features. This may be explained by the types of activities girls are usually involved in – dance, ballet, gymnastics, etc., where the quality of the body posture plays an important role, however it is just a speculation.

The results in both groups of girls and boys are even. Boys scored worse in the reach while sitting test where a slight hindering factor was the body height (taller boys suffer more from shortened back thigh muscles). This may also be explained by a gender difference in the choice of activities practiced on regular basis, which may have an influence on this specific feature.

Children who practice an organized activity more often have a smaller amount of the subcutaneous body fat and score better in physical fitness tests. Most notably in the endurance test. Our findings correspond with previously conducted scientific studies in this matter.

Children with a higher amount of body fat showed poorer performance in all tests of the physical fitness. This creates the infamous vicious circle in which it is hard to tell the cause from the result, whether the body structure limits the performance or the lack of physical activity results in a higher amount of the body fat.

Although the amount of the body fat seems to be the limiting factor in all components of physical fitness, the BMI index correlated only with the endurance test. As expected, children with a higher BMI index scored worse in the 1000-m run.

As the children grow older and taller, the amount of body fat grows. Although the relations were rather weak, other studies conducted in this field show that the situation may get worse.

In young school-aged children the level of maturity and genetical factors may play a more important role than the amount of physical activity. This needs to be taken into consideration while making conclusions. From our findings, we may only predict a certain negative trend, which might get worse once puberty is reached, which again corresponds with the results of other studies.

As much as it is important to observe the body posture, the assessment methods are rather limiting in conducting further longitudinal or more extensive studies. The tests based on visual assessment will always be a question of a subjective evaluation. However, if the assessment of the whole study group is carried out by one experienced evaluator, preferably a physiotherapist, we may compare the result within such a group quite objectively and these results may serve their purpose. The assessment based on visual evaluation is not suitable for further longitudinal research and the results cannot really be compared with other studies. To make such a study more objective, 2-3 evaluators should be assessing the sample and the final results would be obtained in accordance with all 3 evaluators, based on the similarities in their assessment.

What is alarming, however, is the number of children with a poor body posture regardless of the amount of physical activity or the level of general fitness. This fact should be a strong impetus for adequate care and attention paid by teachers, sport educators and parents. Thus, corresponding compensatory activities, specific exercises dealing with body posture and observations of deviations in body posture should be their priority.

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OPTIMIZING SPORTS PERFORMANCE THROUGH MENTAL TOUGHNESS: PILOT STUDY

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ABSTRACT. Background. Mental toughness is one of the most important and well-known psychological constructs in sports and beyond. Researchers in the field, argue that the development of mental toughness is based on both the influences of the environment in which the person operates and the learning and training processes that it went through them. "Gold Medal - Metal Training" it's a program for developing mental toughness and it's based on the work of several psychologists and coaches from Eastern Europe and Scandinavia. **Aims.** The aim of the present study was to verify the 4 essential aspects (process, resources, management and scientific) of the intervention program. **Methods.** The sample of this study consisted of N = 16 participants (31.8% male and 68.8% female), from a diverse range of sports (Judo, Hockey, Basketball, Triathlon, Dance, Athletics). Of these, 8 are performance athletes, and 8 are amateurs. Their age ranged from 19 to 44 years with a mean of M = 25.81 (SD = 7.70). Self-reports were obtained from all athletes regarding their mental toughness (Mental toughness Inventory) and the feasibility of the intervention program through a questionnaire in accordance with the objectives of the study. **Results.** Regarding the difference between statistical test indicate significant difference for item 2, item 3 and item 9. For the difference between the level of physical activity statistical test indicate significant difference for item 2. The results obtained in the ANOVA analysis with repeated measurements F (1, 15) = 8.257 (p = 0.012, MSE = 5.181, η^2 = 0.355) the F test is statistically significant despite the small sample size because the value of Eta (η^2) far exceeds the threshold (> 0.14) in terms of a large effect. **Conclusions.** According to the results, the study is feasible with slight changes related to the implementation and organization of the process, so the coordinator must be more active in collaborating with subjects and provide them with information and suggestions more often.

***Key words**: mental toughness, mental toughness program, sport performance, pilot study, Gold medal mental workout, Mental Toughness Inventory.*

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REZUMAT. ***Optimizarea performanței sportive prin intermediul conceptului Mental Toughness: studiu pilot.*** **Introducere.** Mental toughness (MT) este unul dintre cele mai importante și bine cunoscute constructe psihologice în sport și nu numai. Cercetătorii din domeniu susțin că dezvoltarea Mental toughness se bazează atât pe influențele mediului în care acționează persoana respectivă, cât și pe procesele de învățare și formare pe care le-a parcurs. „*Medalia de aur – antrenament mental*" este un program pentru dezvoltarea Mental toughness și se bazează pe munca mai multor psihologi și antrenori din Europa de Est și Scandinavia. **Obiective.** Scopul acestei lucrări a fost de a verifica cele 4 aspecte esențiale (proces, resurse, management și științific) ale programului de intervenție. **Metode.** Eșantionul acestui studiu a fost format din N = 16 participanți (31,8% bărbați și 68,8% femei), dintr-o gamă variată de sporturi (judo, hochei, baschet, triatlon, dans, atletism). Dintre aceștia, 8 sunt sportivi de performanță, iar 8 sunt amatori. Vârsta acestora a variat între 19 și 44 de ani, cu o medie de M = 25,81 (SD = 7,70). Aceștia au completat 2 chestionare, primul cu scopul de a măsura nivelul Mental toughness (Inventarul Mental toughness), iar al doi-lea fiind un chestionar care viza fezabilitatea programului de intervenție în conformitate cu obiectivele studiului. **Rezultate.** În ceea ce privește genul subiecților testul statistic a arătat diferențe semnificative pentru itemul 2, itemul 3 și itemul 9. Pentru diferența dintre nivelul de practicare a activității fizice testul statistic indicați diferența semnificativă pentru itemul 2. Pe baza rezultatelor obținute în cadrul analizei ANOVA cu măsurători repetate F (1 , 15) = 8,257 (p = 0,012, MSE = 5,181, η^2 = 0,355) testul F este semnificativ statistic în ciuda dimensiunii reduse a eșantionului, deoarece valoarea Eta (η^2) depășește cu mult pragul (> 0,14) în ceea ce privește un efect mare. **Concluzii.** Conform rezultatelor, studiul este fezabil cu modificări ușoare legate de implementarea și organizarea procesului, astfel încât coordonatorul trebuie să fie mai activ în colaborarea cu subiecții și să le ofere informații și sugestii mai des.

Cuvinte cheie: *Mental toughness, program Mental toughness, performanță sportivă, studiu pilot, Medalia de aur – antrenament mental, Inventarul Mental toughness.*

Introduction

Mental toughness is one of the most important and well-known psychological constructs in sports and beyond. Several authors (Clough, Earle & Sewell, 2002; Crust, 2007; Jones & Moorehouse, 2007; Loehr, 1986; Cowden & Meyer-Weitz, 2016) have stated that mental toughness is a psychological construct that supports success, excellence, and performance in sports.

Therefore, performance is based on innovation, competitive advantage, success, there are few constructs that resonate as strongly with people as mental toughness. The concept of mental toughness has attracted the attention

of both researchers and coaches and practitioners through the volume of research on the construct and its conceptualization. It is not surprising that mental toughness has become one of the most widespread concepts in the broad field of psychological training (Gucciardi, 2017).

Sports psychologists (Bull, Albinson & Shambrook, 1996; Gibson, 1998; Goldberg, 1998; Loehr, 1995) state that a person's MT level can be influenced. The development of MT through the certain mental skills in programs aimed at influencing performance have been proposed by some authors (Goldberg, 1998; Loehr, 1986; Watts, 1978) as a means of developing MT. Although it has been found that a good part of MT is related to social experiences, there are also aspects of MT that can be learned (Gordon, 2005).

Researchers in the field (Connaughton, Wadey, Hanton & Jones, 2008; Gucciardi, Gordon & Dimmock, 2009; Weinberg, Butt & Culp, 2011) argue that the development of MT is based on both the influences of the environment in which the person operates and the learning and training processes that it went through them. It has not been established which of these two methods is more beneficial, but neither can it be a question of establishing a ranking, but rather of combining these two methods for a maximum yield (Crust, 2008).

Regarding the effectiveness of intervention programs, several authors (Bell, Hardy & Beattie, 2013; Bhambri, Dhillon & Sahni, 2005; Gucciardi et al., 2009) support their effectiveness in the development of MT. Although both the implementation period of the programs was different from one study to another (2 weeks (Bhambri et al., 2005) to 2 years (Bell et al., 2013), and their content were different (multidisciplinary programs, programs targeting different key attributes of MT or programs targeting different psychological abilities) these have had a positive impact on the MT level of athletes (tennis players, footballers or cricketers). According to the results of Bell et al. (2013), reported that the MT level was approximately the same at the initial measurement in the case of the MT analysis on 2 groups (control and intervention), after the intervention the MT level of the control group remained the same, and in the case of the intervention group recorded significant differences ($p = .003$). Bhambri et al. (2005), in his study conducted on 4 groups recorded differences in the level of MT. Three of the groups differed on the MT level compared to the control group. These 3 groups received different intervention programs, but even so they all recorded MT increases compared to the control group. Moreover, Gucciardi et al. (2009) argue that both intervention programs aimed at the development of MT and programs aimed at developing psychological skills have seen positive changes in the level of MT and resilience compared to the control group.

Over time, several experts in the field have proposed intervention programs in order to develop MT, the intervention program chosen for this study will be presented below.

Gold medal mental workout. It is a MT development program created by Dariusz Nowicki, who is a psychologist and coach of the Polish Judo team, with numerous international medals. Starting from the idea that any method that contributes to sports performance must be used and that most of the time when 2 opponents are of the same level in terms of physical training, the one who wins you will be the one who is stronger mentally. He states that there is a possibility that a well-trained athlete will lose to another less physically fit but with a strong mind (Dariusz Nowicki, 1997). The "Gold Medal - Metal Training" program is based on the work of several psychologists and coaches from Eastern Europe and Scandinavia and includes a user manual that offers implementation suggestions and 12 audio materials that have different themes (for example: breath control, relaxation muscle, mental relaxation, sportsmanship, recovery).

Objectives

According to Thabane et al. (2010) the objectives of a pilot study focus on 4 essential aspects: the implementation process, resources, management and scientific character. Therefore, this study aimed to verify the 4 aspects (process, resources, management and scientific) of the intervention program.

Materials and methods

Participants

The sample of this study consisted of N = 16 participants (31.8% male and 68.8% female), from a diverse range of sports (Judo, Hockey, Basketball, Triathlon, Dance, Athletics). Of these, 8 are performance athletes, and 8 are amateurs. Their age ranged from 19 to 44 years with a mean of M = 25.81 (SD = 7.70).

Instruments

Mental Toughness Inventory (Gucciardi, Hanton, Gordon, Mallett & Temby, 2015) self-reported measure was used to operationalize mental toughness. Participants were asked to indicate how true each of the statements are (e.g., "I strive for continued success" and "I am able to regulate my focus when performing tasks") as an indication of how they typically think, feel, and behave as an athlete using a 7-point response scale (ranging from 1 = false, 100% of the time, to 7 = true, 100% of the time).

Questionnaire that according to the objectives of the study investigates the 4 aspects (process, resources, management and scientific). Participants were asked to answer items on a scale of 1 to 5 (where 1 = total disagreement and 5 = total agreement). Among the items being "it was easy for me to respect the coordinator's requirements", "I think the program needs too much time" and "I need someone to remind me when I have to run the program".

Procedure

Participants were informed about the purpose and objectives of the study. After their agreement, an initial MT level measurement was performed. Later, an online group was created where they received directions and materials to listen to. These materials were sent every 3 days, and after each material the MT level was measured again. At the end of the program, the final value of MT was measured and a feasibility questionnaire was applied according to the research objectives.

Results

According to the objectives set, the results of the study are to be presented for each aspect.

Process

The progress and effective implementation of the intervention is measured by this aspect. The items representative of the process in the feasibility questionnaire being item 1- "*it was easy for me to comply with the coordinator's requirements*", item 4 "*I had difficulties in implementing and carrying out the intervention*" and item 9 "*I consider that the audio listening sessions should be more frequent*". According to the answers given, the participants did not encounter difficulties in implementing and carrying out the intervention.

The descriptive statistics of the items from the feasibility questionnaire regarding the intervention implementation process are presented in table 1.

Table 1. Descriptive statistics of the items that represent the Process

Item	Minimum	Maximum	Mean	Std. Deviation
1	4.0	5.0	4.94	.25
4	1.0	4.0	1.19	.75
9	3.0	5.0	4.19	.91

The average item 1 is 4.94, this represents the ease with which the participants managed to meet the requirements of the coordinator, the average item 4 shows us the extent to which they encountered difficulties in carrying out and implementing the intervention. According to item 9, the subjects consider this intervention to be useful and that the sessions should be more than 2 per week. The descriptive statistics by gender of the items representative of the process are presented in table 2.

Table 2. Descriptive statistics on gender

Item	Gender	N	Mean	Std. Deviation	Std. Error Mean
1	M	5	4.80	.45	.20
	F	11	5.00	.00	.00
4	M	5	1.60	1.34	.60
	F	11	1.00	.00	.00
9	M	5	5.00	.00	.00
	F	11	3.82	.87	.26

For the difference between the gender categories, item 1 registers a difference of 0.20, the girls having a higher score, but the calculated statistical test indicates a value t (14) = 1.56 (p = 0.14) indicates an insignificant difference. Item 4 registers a difference of 0.60, the boys having a higher score, the calculated statistical test indicates a value t (14) = 1.45 (p = 0.14) the difference being insignificant. Item 9 registers a difference of 1.18, the boys having a higher score, the calculated statistical test indicates a value t (14) = 2.97 (p = 0.01) the difference being significant.

Descriptive statistics of the items according to the level of practice of the sports activity are presented in table 3.

Table 3. Descriptive statistics on the level of practicing sports activities

Item	Level	N	Mean	Std. Deviation	Std. Error Mean
1	P	8	4.88	.35	.13
	H	8	5.00	.00	.00
4	P	8	1.38	1.06	.38
	H	8	1.00	.00	.00
9	P	8	4.25	1.04	.37
	H	8	4.13	.83	.30

Regarding the difference between the categories of physical activity, item 1 registers a difference of 0.12, those who practice at hobby level have a higher score, but the calculated statistical test indicates a value t (14) = 1.00 (p=0.33) indicate an insignificant difference. Item 4 registers a difference of 0.38, those who practice at the performance level with a higher score, the calculated statistical test indicates a value t (14) =1.00 (p = 0.33) the difference being insignificant, and item 9 registers a difference of 0.12, those who practice at the level of performance having a higher score, the calculated statistical test indicates a value t (14) = 0.27 (p = 0.80) the difference being insignificant.

Resources

This aspect analyzes the needs of the subjects (time, devices, knowledge) for the implementation of the intervention. The representative items of this aspect are item 2 "*I think the program needs too much time*", item 5 "*it was difficult for me to understand the program*" and item 6 "*I easily completed the program and its content*". According to the answers, the program does not need too much time to be implemented, and its content did not impose problems on the participants.

The descriptive statistics of the items from the feasibility questionnaire regarding the resources necessary for the intervention are presented in table 4.

Table 4. Descriptive statistics of the items that represent the Resources

Item	Minimum	Maximum	Mean	Std. Deviation
2	1.0	5.0	1.94	1.18
5	1.0	1.0	1.00	.00
6	4.0	5.0	4.81	.40

The average item 2 shows the extent to which participants consider that the intervention needs too much time. According to item 5, participants do not need special knowledge or skills to understand the content, and item 6 represents the ease of completing the program and their openness to such interventions.

Table 5 presents the descriptive statistics by gender of the items representative of this aspect.

Table 5. Descriptive statistics on gender

Item	Gender	N	Mean	Std. Deviation	Std. Error Mean
2	M	5	3.40	.89	.40
	F	11	1.27	.47	.14
5	M	5	1.00	.00	.00

Item	Gender	N	Mean	Std. Deviation	Std. Error Mean
6	F	11	1.00	.00	.00
	M	5	5.00	.00	.00
	F	11	4.73	.47	.14

Item 2 has a difference of 2.12, the boys with a higher score, the calculated statistical test indicates a value t (14) = 6.36 (p = 0.00) the difference being significant. Item 5 does not differ. Item 6 registers a difference of 0.27, the boys having a higher score, the calculated statistical test indicates a value t (14) = 1.48 (p = 0.22) the difference being insignificant.

Below, in table 6 are the descriptive statistics on the level of practicing the sports activity.

Table 6. Descriptive statistics on the level of physical activity

Item	Level	N	Mean	Std. Deviation	Std. Error Mean
2	P	8	2.88	.99	.35
	H	8	1.00	.00	.00
5	P	8	1.00	.00	.00
	H	8	1.00	.00	.00
6	P	8	4.63	.52	.18
	H	8	5.00	.00	.00

Regarding the differences between the level of practicing sports activities, item 2 has a difference of 1.88, those who practice at the performance level with a higher score, but the calculated statistical test indicates a value t (14) = 5.35 (p = 0.00) the difference being significant. Item 5 does not differ. Item 6 registers a difference of 0.37, those who practice at hobby level having a higher score, the calculated statistical test indicates a value t (14) = 2.05 (p = 0.06) the difference being insignificant.

Management

This aspect represents the process of organizing and implementing the intervention. The representative items of this aspect are item 3 "*I happened to forget to listen to the audio materials*", item 7 "*it is difficult to run the program if I am not at home*" and item 8 "*I need someone to remind me when I have to run the program*". Subjects did not encounter problems in managing the study. The results show that organization, location or time were not an issue to meet and implement the requirements of the intervention.

The descriptive statistics of the items from the feasibility questionnaire regarding the managerial aspects necessary for the intervention are presented in table 7.

Table 7. Descriptive statistics of the items that represent the managerial aspects

Item	Minimum	Maximum	Mean	Std. Deviation
3	1.0	4.0	2.13	1.50
7	1.0	2.0	1.13	.34
8	1.0	2.0	1.56	.51

The mean of item 3 show if participants forgot to comply with what was required of them, while item 7 shows us that it was not difficult for them to meet the requirements if they were not at home. Item 8 it shows us that they don't need someone to remind them of what they have to do.

Table 8 presents the descriptive statistics by gender of the items representative of the managerial aspect.

Tabel 8. Descriptive statistics on gender

Item	Gender	N	Mean	Std. Deviation	Std. Error Mean
3	M	5	1.00	.00	.00
	F	11	2.64	1.57	.47
7	M	5	1.00	.00	.00
	F	11	1.18	.40	.12
8	M	5	1.80	.45	.20
	F	11	1.46	.52	.16

Item 3 registers a difference of 1.64, the girls having a higher score, but the calculated statistical test indicates a value t (14) = 2.30 (p = 0.04) the difference being significant. Item 7 registers a difference of 0.18, the girls having a higher score, the calculated statistical test indicates a value t (14) = - 0.99 (p = 0.34) the difference being insignificant. Item 8 registers a difference of 0.34, the boys having a higher score, the calculated statistical test indicates a value t (14) = 1.28 (p = 0.34) the difference being insignificant.

The descriptive statistics of the items representative of the managerial aspect on the level of practicing the sports activity are presented in table 9.

Table 9. Descriptive statistics on the level of physical activity

Item	Level	N	Mean	Std. Deviation	Std. Error Mean
3	P	8	2.13	1.55	.55
	H	8	2.13	1.55	.55
7	P	8	1.00	.00	.00
	H	8	1.25	.46	.16
8	P	8	1.50	.53	.19
	H	8	1.63	.52	.18

Item 3 records no differences. Item 7 registers a difference of 0.25, those who practice at hobby level having a higher score, the calculated statistical test indicates a value t (14) = 1.53 (p = 0.15) the difference being insignificant. Item 8 registers a difference of 0.13, those who practice at hobby level with a higher score, the calculated statistical test indicates a value t (14) = - 0.48 (p = 0.64) the difference being insignificant.

Scientific

With the help of this aspect, the effect generated by the intervention is presented. The Mental Toughness Inventory proposed by Gucciardi et al. (2015) was used to measure MT. For the analysis of the results we used ANOVA with repeated measurements. Following the analysis, the results showed for the initial measurement of MT an average of M = 49.13, and in the case of the final measurement M = 51.62. Therefore, based on the results obtained in the ANOVA analysis with repeated measurements F (1,15) = 8.257 (p = 0.012, MSE = 5.181, η^2 = 0.355) the F test is statistically significant despite the small sample size because the value of Eta (η^2) far exceeds the threshold (> 0.14) in terms of a large effect.

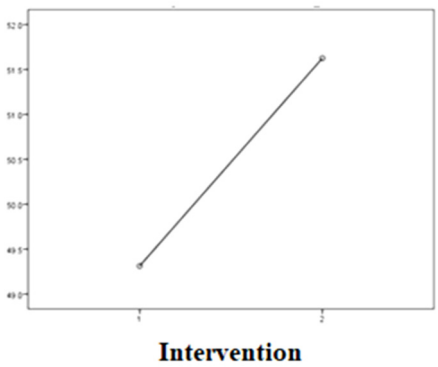

Fig. 1. Graph the effect size

The effect size is shown in Figure 1. The graph represents the differences between the 2 measurements, pretest and posttest.

Discussion and Conclusions

According to the results, in the case of the gender analysis of the feasibility questionnaire, item 2 registers a significant difference t (14) = 6.36 (boys with higher score), this item measuring the time resources of the participants to go through the materials. This may be due to the boys' higher training volume program or their busier schedule. Regarding item 3, it showed significant differences t (14) = 2.30 (girls with a higher score). Item 3 measures the management dimension of the study, more precisely, the extent to which they forgot to follow the instructions given by the coordinator, suggesting that in the study, the coordinator should be more careful and remind participants of the tasks they have to perform. Item 9 showed a significant difference t (14) = 1.28 (boys with higher score). Item 9 represents the desire of the subjects to be more frequent the sessions of implementation of the program, in the present study they being in number of 2 per week.

Regarding the analysis of the feasibility questionnaire on the levels of practicing the sport activity, item 2 showed significant differences t (14) = 5.35 (those who practice physical activities in performance regime with a higher score). The time resource may be less for performance athletes due to the training process which involves a higher volume and additional recovery time due to heavy and exhausting workouts.

According to the results, the study is feasible with slight changes related to the implementation and organization of the process, so the coordinator must be more active in collaborating with subjects and provide them with information and suggestions more often. We propose that in the main study the subjects be part of groups in which they regularly receive messages with implementation instructions and messages that remind them of the tasks required by the program. From a scientific point of view, the effect of the intervention proved to be great, which supports the process of implementing the intervention.

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STUDY ON THE ROLE OF DYNAMIC GAMES IN THE PHYSICAL EDUCATION LESSON AT IV CLASS LEVEL

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ABSTRACT. The choice of a topic related to the role of dynamic games, on their learning and organization, involves a whole series of issues related mainly to the programming of the lesson systems, as well as the respect of the didactic principles. In this sense, the article aims to review the methodical requirements for the organization and development of dynamic games and their role in the development of the child. By content, form and effects, it presents some advantages over other physical exercises, offering favorable conditions for the simultaneous development of basic or specific motor skills, motor qualities, as well as psychic processes and personality traits. Its multiple educational values explain the inclusion of dynamic play, as a means of physical education, in the content of all lessons, at all classes of students, at all ages. Dynamic games are not only a means of physical education, but also a method of education. That is why we aim to highlight the educational role of dynamic games at the 4th grade level. Due to the influence on the whole personality of the child, dynamic games are the way in which the teacher can respond to the phrase: "**Healthy mind in a healthy body**".

Keywords*: dynamic games, lesson systems, didactic principles, the role of dynamic games, qualities and motor skills, means of physical education, method of education, healthy mind in healthy body.*

REZUMAT. ***Studiu privind rolul jocurilor dinamice în lecţia de educaţie fizică la nivelul claselor a IV-a.*** Studiul privind rolul jocurilor dinamice, asupra învăţării şi organizării acestora, implică o serie întreagă de aspecte legate în principal de programarea sistemelor de lecţii, cât şi de respectarea principiilor didactice. În acest sens, acest articol îşi propune a trece în revistă cerinţele metodice de organizare şi desfăşurare a jocurilor dinamice şi rolul acestora în dezvoltarea copilului. Prin conţinut, formă şi efecte, prezintă unele avantaje fată de alte exerciţii fizice, oferind condiţii favorabile de dezvoltare simultană a deprinderilor motrice de bază sau specifice, a calităţilor motrice, precum şi a proceselor psihice şi a trăsăturilor de personalitate. Multiplele sale

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valenţe educative explică includerea jocului dinamic, ca mijloc al educaţiei fizice, în conţinutul tuturor lecţiilor, la toate clasele de elevi, la toate vârstele. Jocurile dinamice nu sunt doar un mijloc al educaţiei fizice, ci şi totodată o metodă de educaţie. De aceea ne propunem să reliefăm rolul educativ al jocurilor dinamice la nivelul clasei a 4-a. Datorită influenţei asupra întregii personalităţi a copilului, jocurile dinamice, constituie modul prin care profesorul poate răspunde sintagmei: „***minte sănătoasă în corp sănătos***”.

Cuvinte cheie*: jocuri dinamice, sisteme de lecţii, principii didactice, rolul jocurilor dinamice, calităţi şi deprinderi motrice, mijloc al educaţiei fizice, metodă de educaţie, minte sănătoasă, corp sănătos.*

Introduction

Dynamic play is one of the most effective and important means of education. Movement games and poles largely ensure that the goals of physical education and sport are met. They favor the simultaneous development of basic or specific motor skills and motor qualities, as well as moral-volitional skills and traits and personality.

The right game learned, influences the student throughout the life. Through him he is accustomed to bear with dignity the defeat, to manifest a spirit of “fair-play”, and to taste of the spirit of victory. Through dynamic games the spirit of sacrifice and perseverance, the courage, having a stronger effect than the spontaneous one are cultivated, provided that the teacher knows not only basic rules of the game but also the technique of their development, his educational influence, developing visual acuity, hearing, intelligence, the spirit of observation and collegiality.

Students in the primary cycle, before approaching certain topics and elements of movement (of dynamics), must know very well the rules of hygiene, basic in maintaining and educating the health, to learn them and to show them with pleasure, proving that I understand their role and purpose. The need for movement and play is one of the fundamental needs of the child. For optimal physical and mental development, light is required.

Dynamic games have an important role in the multilateral physical development of the students, in maintaining and strengthening the health, in creating a disposition, which is why I recommend including them in the physical education lesson. Well chosen and organized with care and conscience, they can have a profound emotional effect, creating a strong sense of satisfaction for those who participate in their performance.

The term "dynamic game" (or motion game) comes from the Latin word "jocus" and the French word "dynamique".

M. Epuran (1990) argues that dynamic games are total activities, attractive, spontaneous, free, natural and disinterested, having recreational and compensatory valences.

Gh. Cârstea (2000), says that "*dynamic games are fun activities, with special implications on personality development and for which active and creative motor actions are characteristic, motivated by its subject (theme, ideas). These actions are partially limited by certain rules and are oriented towards overcoming different difficulties (obstacles) to achieve the proposed objectives (to win, to conquer, to own certain processes, etc.)".*

Objectives

In this sense, we assume that following the use of motion games, within the lesson of physical education and sport, will improve the indications regarding the results of the norms of the motor qualities (speed, skill, strength, endurance, etc.).

Following the experiment, the measurements made and the use of the games, the proposed hypothesis will be verified as follows: based on the data provided by the specialized literature in this field, as well as from my own experience, we have formulated some general and specific theoretical considerations accompanied by proposals whose efficiency will be confirmed later, at the final tests in the paper. The results of the control norms regarding the motor qualities of the experiment were substantially improved, these being presented and detailed later in the chapter on the analysis of the results.

Materials and methods

The place of the experiment

Figure 1. The basket field

Figure 2. The handball field

The initial and final tests were carried out both on the sports field of the Andrei Şaguna High School in Deva (running speed 5x5 m commute) and in the school's gymnasium (long jump on site and vertical target throw).

Anthropometric measurements were made within the school's gymnasium, using means and materials from the school's equipment, as well as in the school's medical office.

All experiments were performed on a sample of 2 relatively homogeneous student classes, from the "Andrei Şaguna" Gymnational School in Deva, 4D control class with a staff of 24 students (16 boys and 8 girls), and experiment 4B class with one effectively of 30 students (16 boys and 14 girls). We used different anthropometric measurements:

Figure 3. Height measurement

Figure 4. Weight measurement

Figure 5. Measuring the width of the arms

Figure 6. Measuring the length of the sole

In the same experiment I conducted a battery of tests at the beginning of the school year and one at the end of the school year from the following tests:

Figure 7. Running speed, 5x5 m commute (motor quality speed - running speed)

Figure 8. Vertical target throw (motor skill - specific skill)

Figure 9. The long jump from the spot (motive force - muscle strength of the lower limbs)

The research methods used and implicitly in the elaboration of this paper are: the documentation, the method of observation, the statistical method, the experiment method, the results of the analysis.

As a structure of the movement games, we presented the type of dynamic games according to: the lesson check, the game title, the objectives pursued, the place of performance,
class, features, number of participants, duration of the game, necessary materials, game description, and the graphic presentation.

In the following we will present some of the dynamic games used in physical education lessons: flower birds, wonder colors, the board, tunel ball, 3 heads, ball in zig zag, flying circle, fight in a foot, the indian dance, colored balls, treadmill, the statues, ducks and hunters, defend the city, the happy country, the airplanes, the border, furious locomotive, never target, destroy the castle, zipper, prepared military, change the side, country country we want to host.

Continuously we will present the graphics of the experience class on height, weight, arm width and the length of the sole:

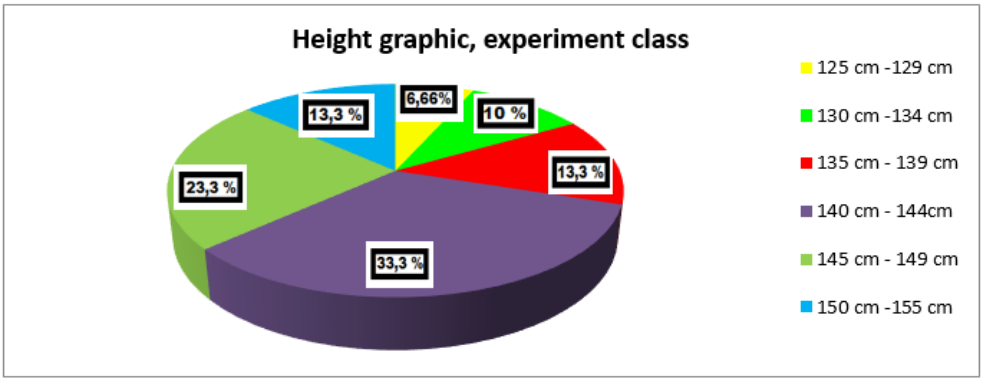

Chart 1. Heigh graphic, experiment class

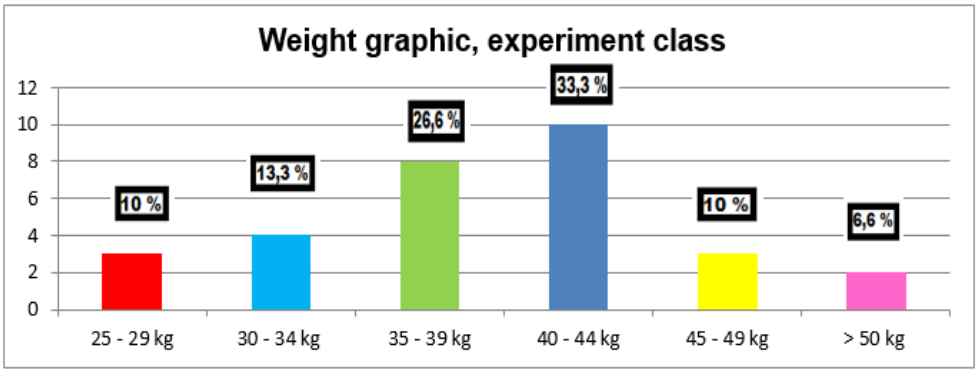

Chart 2. Weight graphic, experiment class

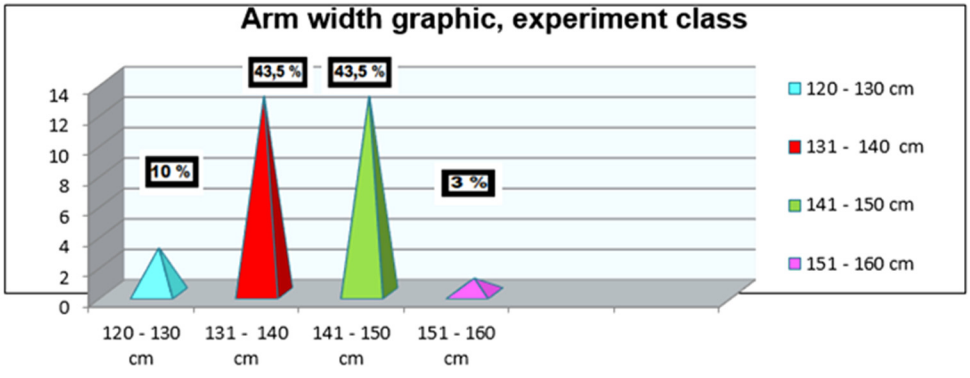

Chart 3. Arm width graphic, experiment class

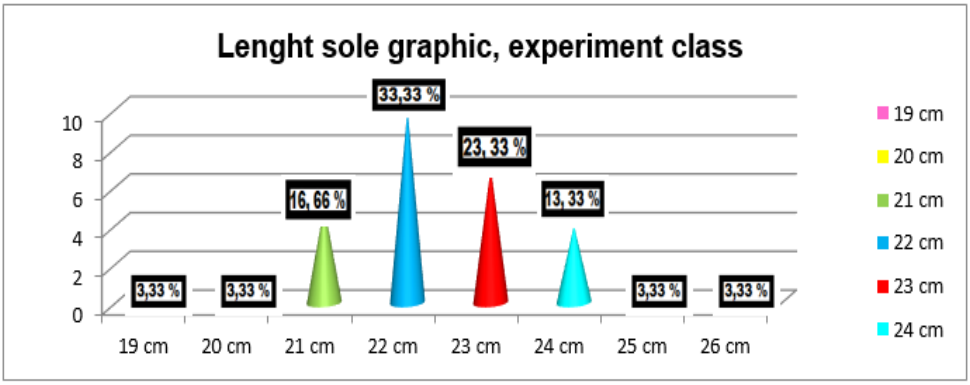

Chart 4. Length sole graphic, experiment class

Data analysis and interpretation, experiment class

At the initial testing (**speed run, speed race, 5x5 m**), the times was between 7, 37 sec. and 12, 11 sec, and at the final testing (**speed run, speed race, 5x5 m),** the times was improved, and it was between 7, 34 sec. and 12, 01 sec.

The average running time, the shuttle race was as follows: at the initial testing, experiment class, the average running speed being 9.32 sec. and at the final test, experiment class, the average running speed is 9.18 sec.

The general time improvement is observed, the average per class decreases from 9.32 sec. at 9.18 sec, thus obtaining an improved value with **0, 14 sec / general.**

At the initial testing (**vertical throwing**), the average of 2/4 throws was 13.33%, the average of 3/4 throws was 50%, and the average of 4/4 throws was 36.33%.

At the final testing (**vertical throwing**), the average of ¾ throws was 46.66%, the average of 4/4 throws was 53.33%.

It is observed that those who succeeded 2/4 throws, obtained better results, increasing a step, to ¾ throws, and those who had ¾ successes throws, increased to 4/4 throws, so that the percentage of success 4/4 throws increased from 36.33% to 53.33%, obtaining as follows:**17 % progress.**

At the initial testing (**long jump**), the results was between 110cm and 170cm.

The percentage of jumps was as follows: between 110 - 119 cm, with a percent of 6.66%, between 120 - 129 cm, a percent of 10%, between 130 - 139 cm a percent of 40%, between 140 - 149 cm a percent of16.66%, and more than > 150 cm, a percent of 26.66%.

At the final testing, (**long jump**,) the results has improved, thus: between 120 and 175cm.

The percentage of jumps was as follows: between 110 - 119 cm a percent of 3.33%, between 120 - 129 cm, a percent of 6.66%, between 130 - 139 cm a percent of 33, 33%, between 140 - 149 cm a percent of 26.66%, and more than > 150cm, a percent of 30%.

It is observed that the jumps were improved in some of the students, so that the class average increased from 138.5 cm to 142 cm, thus obtaining an additional value **3.5 cm / class average**.

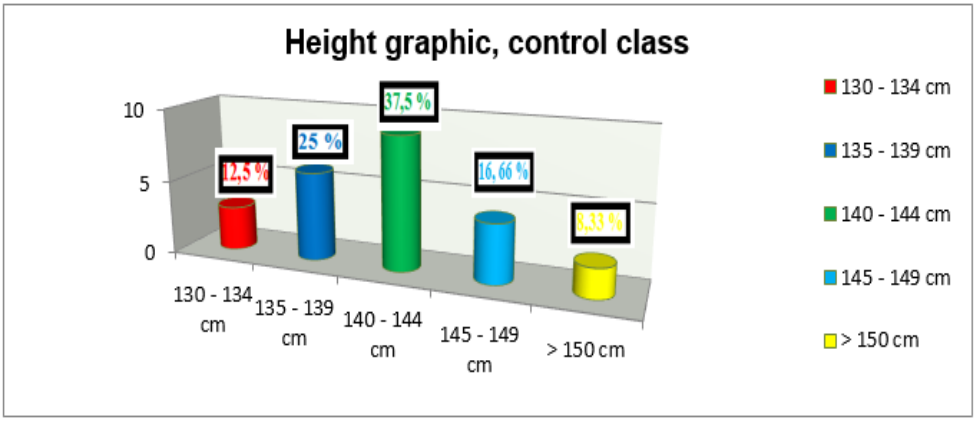

Chart 5. Height graphic, control class

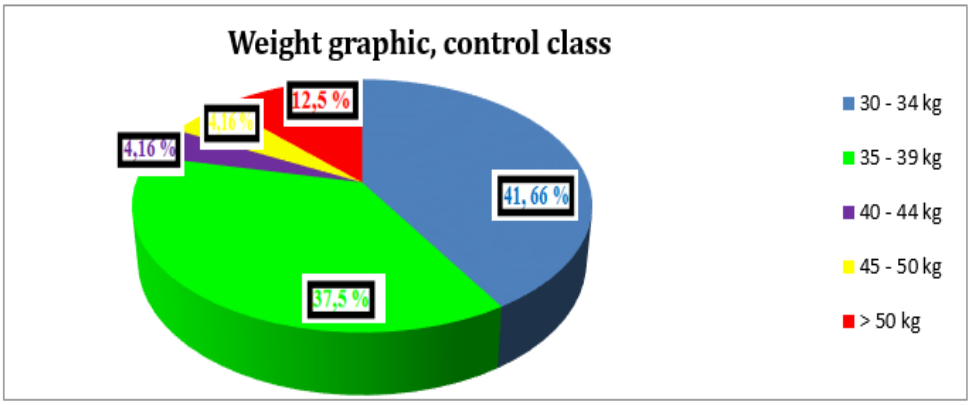

Chart 6. Weight graphic, control class

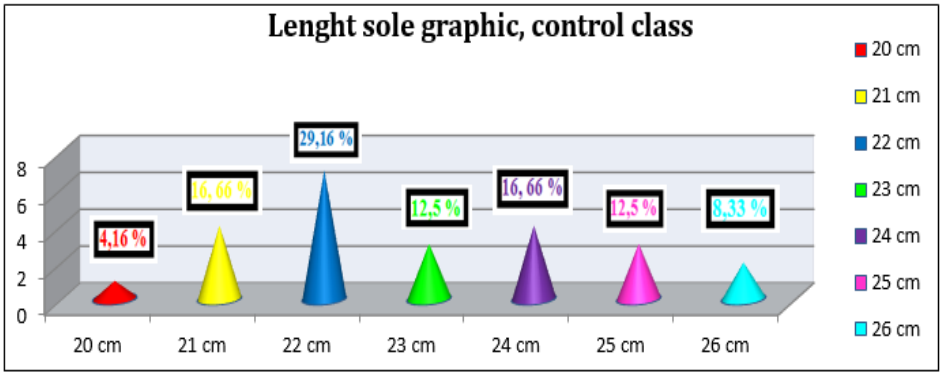

Chart 7. Length sole graphic, control class

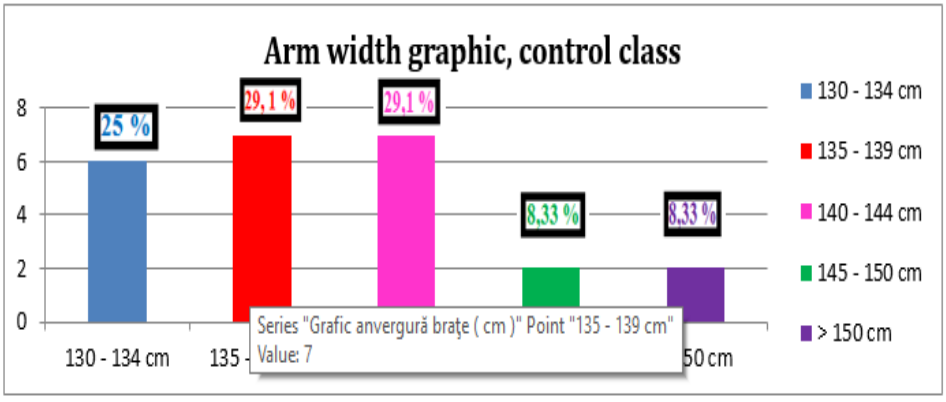

Chart 8. Arm width graphic, control class

Data Analysis and interpretation of results, control class

At the initial testing, **speed running, shuttle race, 5x5 m**, the times were between 7, 72 sec. and 12, 39 sec. At the final test, **speed running, shuttle race, 5x5 m,** the times had improved and it was between 7, 27 sec. and 12, 18 sec.

The average running time, the shuttle race was as follows:

At the initial testing, control class, the average running speed being 9.37 sec. At the final test, control class, the average running speed is 9.19 sec.

The general time improvement is observed, the average per class decreases from 9.37 sec. at 9.19 sec, thus obtaining an improved value with **0, 18 sec / general**.

At the initial testing, **vertical target throw**, the average of 2/4 throws was 16.66% percent, the average of 3/4 throws was 37.50% percent, and the average of 4/4 throws was 45.83% percent. At the final testing, **vertical target throw**, control class, the average of 3/4 throws was 41.66% percent, the average of 4/4 throws was 58.33% percent.

It is observed that those who succeeded 2/4 throws, obtained better results, increasing a step, to 3/4 throws, and those who had 3/4 successes throws, increased to 4/4 throws, so the percentage of success 4/4 throws increased from 45.83% to 58.33%, thus obtaining a **progress of 12,5%**.

At the initial testing**, long jump,** the results between 110cm and 170cm.

At the control class, the jump percentage was as follows: between 110 - 119 cm - 4.16% percent, between 120 - 129 cm - 12.5% percent, between 130 - 139 cm - 33.3% percent, between 140 - 149 cm -16.66 % percent, and more than > 150 cm - 33.33% percent.

At the final testing, **long jump**, the results have improved, between 115cm and 175cm.

At the control class, the percentage of jumps was as follows: between 110 - 119 cm - 4.16% percent, between 120 - 129 cm -4.16% percent, between 130 - 139 cm -37.5% percent, between 140 - 149 cm -20.83 % percent, and more than > 150cm- 33.33% percent.

It is noticed that the jumps were improved in some of the students, so that the class average increased from 141.25 cm to 143.95 cm, thus improving with the **2.7 cm/class average.**

Conclusions and proposals

As a result of the obtained results, it is observed that the indices of the basic motor qualities of the work have been substantially improved, namely:

The experiment class:

- **Speed indices are improved by 0.14 sec;**
- **Within the target throw, a 17% progress is observed;**
- **In the long jump from the spot, the progress with 3.5 cm.**

In the witness class:

- **Speed indices are improved by 0.18 sec;**
- **In the target shooting, there is a 12.5% progress;**
- **In the long jump from the spot, you can see the progress with 2.7 cm.**

I propose both from the point of view of a physical education and sports teacher, and from the point of view of a physical therapist, that in the physical education lesson, different attractive exercises, competitions, sports games, applied sticks, and especially dynamic games, will be used. To lead to the creation of a good mood and well-being of the students, an atmosphere of relaxation, joy and good will.

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APPENDIX

Name and surname	Initial test class experiment running speed race 5x5 m	Initial test class experiment vertical throwing at the target	Initial test class experiment jumping in length
A.L.	7,99 s	4/4	170 cm
A.A.	9,41 s	3/4	150 cm
B.A.	9,28 s	3/4	130 cm
B.R.	10,01 s	3/4	125 cm
B.I.	8,62 s	4/4	145 cm
B.L.	9,22 s	2/4	130 cm
B.R.	9,34 s	3/4	130 cm
C.A.	9,36 s	4/4	135 cm
C.C.	8,83 s	3/4	140 cm
D.A.	10,41 s	2/4	120 cm
D.A.	9,43 s	3/4	145 cm
D.I.	10,46 s	4/4	130 cm
I.I.	10,18 s	2/4	130 cm
J.A.	10,33 s	3/4	125 cm
K.I.	8,18 s	3/4	135 cm
L.R.	8,38 s	4/4	140 cm
M.B.	9,23 s	3/4	140 cm
M.R.	8,93 s	4/4	150 cm
M.R.	8,77 s	4/4	165 cm
O.R.	8,57 s	4/4	155 cm
O.D.	9,24 s	3/4	130 cm
O.D.	10,20 s	3/4	135 cm
O.D.	8,90 s	4/4	150 cm
P.L.	8, 43 s	3/4	135 cm
P.I.	11,89 s	2/4	115 cm
P.A.	9,16 s	3/4	130 cm
S.L.	8,71 s	3/4	135 cm
S.T.	7,37 s	4/4	170 cm
S.D.	8,70 s	4/4	150 cm
V.I.	12,11 s	3/4	115 cm
A.L.	7,92 s	4/4	175 cm
A.A.	9,31 s	4/4	150 cm
B.A.	9,22 s	3/4	135 cm
B.R.	9,88 s	3/4	130 cm
B.I.	8,52 s	4/4	150 cm
B.L.	9,11 s	3/4	130 cm
B.R.	9,18 s	3/4	130 cm

Name and surname	Initial test class experiment running speed race 5x5 m	Initial test class experiment vertical throwing at the target	Initial test class experiment jumping in length
C.A.	9,16 s	4/4	140 cm
C.C.	8,68 s	3/4	145 cm
D.A.	10,34 s	3/4	125cm
D.A.	9,34 s	4/4	145 cm
D.I.	10,22 s	4/4	130 cm
I.I.	10,03 s	3/4	130 cm
J.A.	10,01 s	3/4	130 cm
K.I.	8,02 s	3/4	140 cm
L.R.	8,04 s	4/4	145 cm
M.B.	9,11 s	4/4	140 cm
M.R.	8,65 s	4/4	155 cm
M.R.	8,62 s	4/4	165 cm
O.R.	8,51 s	4/4	165 cm
O.D.	9,14 s	3/4	135 cm
O.D.	9.98 s	4/4	140 cm
O.D.	8,67 s	4/4	155 cm
P.L.	8,41 s	3/4	135 cm
P.I.	11,80 s	3/4	120 cm
P.A.	9,03 s	3/4	135 cm
S.L.	8,58 s	3/4	140 cm
S.T.	7,34 s	4/4	175 cm
S.D.	8,61 s	4/4	155 cm
V.I.	12,01 s	4/4	115 cm

Name and surname	Initial test control class running speed race 5x5 m	Initial test control class vertical throwing at the target	Initial test control class jumping in length	Name and surname	Final test control class running speed race 5x5 m	Final test control class vertical throwing at the target	Final test control class jumping in length
B.C.	8,80 s	4/4	155 cm	B.C.	8,70 s	4/4	160 cm
B.A.	9,81 s	3/4	140 cm	B.A.	9,66 s	3/4	145 cm
B.A.	10,09 s	2/4	130 cm	B.A.	10,03 s	3/4	130 cm
B.A.	9,34 s	3/4	130 cm	B.A.	9,11 s	4/4	130 cm
B.R.	9,01 s	3/4	120 cm	B.R.	8,98 s	3/4	125 cm
B.B.	8,05 s	4/4	145 cm	B.B.	8,02 s	4/4	145 cm
B.B.	12,39 s	2/4	125 cm	B.B.	12,18 s	3/4	130 cm
B.P.	11,17 s	3/4	130 cm	B.P.	11,10 s	3/4	135 cm

Name and surname	Initial test control class running speed race 5x5 m	Initial test control class vertical throwing at the target	Initial test control class jumping in length	Name and surname	Final test control class running speed race 5x5 m	Final test control class vertical throwing at the target	Final test control class jumping in length
B.A.	9,50 s	4/4	150 cm	B.A.	9,32 s	4/4	150 cm
C.R.	8,78 s	3/4	130 cm	C.R.	8,71 s	3/4	130 cm
D.A.	8,85 s	3/4	140 cm	D.A.	8,61 s	4/4	140 cm
G.M.	10,08 s	4/4	150 cm	G.M.	10,03 s	4/4	150 cm
I.L.	9,03 s	4/4	165 cm	I. L.	8.56 s	4/4	170 cm
I.A.	7,81 s	4/4	170 cm	I.A.	7,65 s	4/4	175 cm
I.A.	9,64 s	2/4	110 cm	I.A.	9,44 s	3/4	115 cm
H.J.	10,73 s	3/4	125 cm	H.J.	10,43 s	4/4	130 cm
L.L.	9,48 s	4/4	130 cm	L.L.	9,16 s	4/4	135 cm
N.F.	9,50 s	3/4	135 cm	N.F.	9,22 s	3/4	135 cm
S.A.	9,11 s	4/4	135 cm	S.A.	9,04 s	4/4	135 cm
S.D.	9,31 s	4/4	145 cm	S.D.	9,12 s	4/4	145 cm
T.A.	8,86 s	3/4	135 cm	T.A.	8,68 s	3/4	140 cm
T.T.	7,72 s	4/4	170 cm	T.T.	7,27 s	4/4	175 cm
V.B.	8,74 s	2/4	165 cm	V.B.	8,61s	3/4	165 cm
Z.D.	9,21 s	4/4	160 cm	Z.D.	9,01 s	4/4	165 cm

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SKI LEARNING DIFFICULTIES OF DIFFERENT SPORT ATHLETES

SZABÓ-CSIFÓ BARNA[1,*], POP ALEXANDRA CRISTINA[2]

ABSTRACT. Skiing is one of the difficult winter sports, which requires a lot of motoric skills as strength of the lower limbs, good balance, determination and courage as well. In this study we aim to observe the learning skills differences between students or adults who competed in different sports, or practiced them just as leisure activities. We are interested that in case of them it is easier or more difficult to learn the skiing skills. As method we established a pointing system from 0 to 2 to make the difference between the subjects, 0 means that they have learning difficulties and they don't succeed to have any skiing skill, 1 is for medium skills and 2 is for those whom realized a good skiing technique, considered that they are beginners. In this study take part a number of 60 subjects, between 20 – 26 ages, and 50 of them practiced in their life sport in competition.

Keywords: *Skiing, learning skills, other sports, difficulty*

REZUMAT. ***Dificultăţile de învăţare a schiului la diferiţi sportivi.*** Skiul este un sport de iarnă dificil, ce necesită o serie de calităţi motrice cum ar fi forţa trenului inferior, un bun echilibru, determinare şi nu în ultimul rând, curaj. În acest studiu dorim să observăm diferenţa dificultăţii de învăţare la studenţi şi adulţi, care în viaţa lor au practicat sport de performanţă sau doar de hobby. Am fost interesaţi să observăm dacă le este mai uşor sau mai greu să însuşească taina schiatului. Ca metodă am stabilit un sistem de punctaj de la 0 la 2 pentru a evidenţia diferenţa dintre subiecţi, 0 însemnând că nu au reuşit să însuşească tehnica elementară a schiului, 1 am acordat pentru cunoştinţe medii, iar 2 pentru cei care au reuşit să execute cerinţele tehnice corecte la nivel de începător. În acest studiu au fost analizaţi 60 de subiecţi, cu vârste cuprinse între 20 – 26 de ani şi 50 dintre ei au practicat sport de performanţă.

Cuvinte cheie: *schi, învăţarea schiului, alte sporturi, dificultate*

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Introduction

The basics of the skiing thnique, means a huge amount of aknowlegment of technical proceedings, learned step by step allows to approach descending the ski sloaps as a recreational activity, or sport activity (Bădău A., Bădău D. 2020).

In his work, Dosek Ágoston submit, that the wintersport don't need a long learning process, and after the accommodation with the snow, they offer a delight for the practicants. But exist a posibility for those who try to learn the skills without a qualifeied technician to lear that skills in a wrong way, and those mistakes will be harder to fix them, that lear them correctly. In the same work, Dosek A. reflect, that the aim of ski coaching is, to consciously acquires a propper skiing technique in available time (Dosek, 2016).

An advantage to learn skiing with a ski specialist is to give personal safety, follow some rules in the teaching process and in a short time the accumulate knowledge is significant superior (Dubecz, 2009). In the same time, they can learn the ethic on the skiing sloaps the 10 rules to follow, pronounced by Sandor I. in his work, "Skisport for everyone" (Sandor, 2013).

The biomechanics of the skiing technique is a very important factor in the learning process. In this case, we have to understand a couples of elements from physics. During the descent, the skier is affected by inside and outside forces. The inside forces are generated by the skier during the tehnical elements what he use, and the external forces are determinated by the steepness of rhe sloap, the quality of the snow (it is soft or icy), this facts are important in competition but in the learning process also. The inside forces are created by the body position during the descent, the balance changing from one leg to the other (changing the edges of the ski) (Barton, 1984).

Objectives

In our study we wish to find if the sports what the subjects practiced before strating to learn skiing, influenced the agility of the skiing skills.

Hypotheses

The hypothesis what we draw up, is that the learning process is influenced by the sports what the subjets practiced before to strat to learn skiing, and it will be influenced also by the tipe of athlete they are.

Methods

In our research we analized 60 persons, between age of 17 – 26 with a mean of 20.42, and 51 from them practiced some sport activity on competition

level. We calculate the standard deviation of the group age and the σ=1.778 show us the significancy of the group. As genders, we have 37 male (61.66%) and 23 female (38.33%) subjects. They take part at different ski camps organized by the University of Babeș-Bolyai Cluj Napoca. A small number of them did not practiced any sport, before our activity. To analize their improvement we generate a pointing system, from 0 to 2. That pointing system we applied to the targeting skills what we try to learn them. This skill are:

- Body position
- Snow plow
- Snow plow arch
- Thwart downhill
- Mountain can't
- Bouncing
- Closing the skies

Fig. 1. Snow plow

Fig. 2. Snow plow arch

Fig. 3. Correct body position

Fig. 4. Stiff body position

Results

Table 1. The main results of the group

Practiced sports	Level of the learned skills
No sports	1.7
Handball	1.43
Football	1.31
Swimming	1.71
Ice hockey	1.6
Basketball	1.33
Judo	1.21
Wrestling	1.48
Athletics	1
Weigth lifting	1.29
Fitness	0.57
Table tennis	1.29
Sport dance	1.86
Triathlon	1.71

Interpretation of results

The statistical analysis conducted allowed us to outline the following aspects:

The main target that to realize a comparative study between learning potentials of different athletes of the skiing skills, our subjects are practiced the following sports: 13 football players, 12 handball players, 2 swimmers, 5 ice hokey players, 7 basketball players, 2 judo wrestlers, 3 wrestlers, 1 athlete, triathlete, weight lifter, table tennis player, fitness practcicant, sport dancer, and 9 subjecys who does not practice any sport in competitions.

The following presentation illustrated the fact of sport practicers in percentage.

During the learning process we observed the most important skills that the subjects must possess at the and of the courses. The scale what we created, show the level, and the success of the skiing improvement.

In this graphical presentation, we can see that the most succesfull element during the learning process was the snow plow, that's because we used in a long time to give the feeling of security for the beginners, this element give the possibility to stop at the and of the slope. Interesting to observe is that the second successful element with a value of 1,98, is the snow

plow arch, that lead us, that the learning process is wery well buils up, this represent the base lements of the skiing skills. The values 1.1 and 1.12 of the body position and bouncing, lead us to declare, that the insecurity on the skies and becouse of this an exaggerated stiffness produced this pooor result.

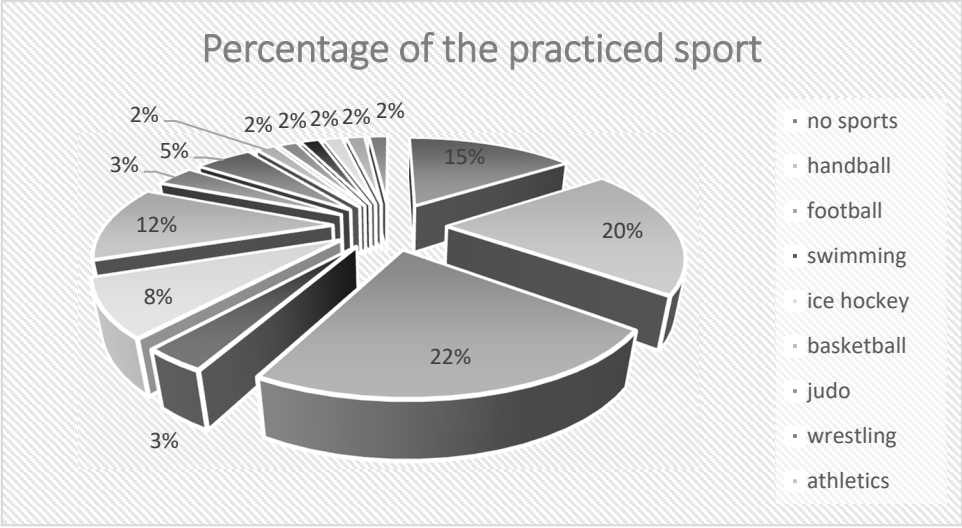

Fig. 5. The percentage of the practiced sports by the subjects

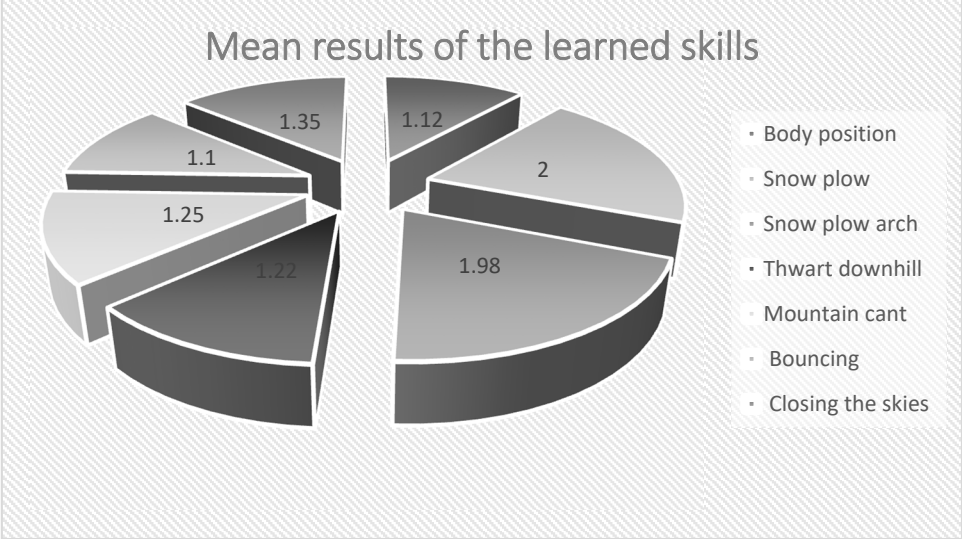

Fig. 6. Graphical presentation of the level of the learned skills

Next we realized a comparative study between the learning potential of the different sport athletes, and we obtained the following results.

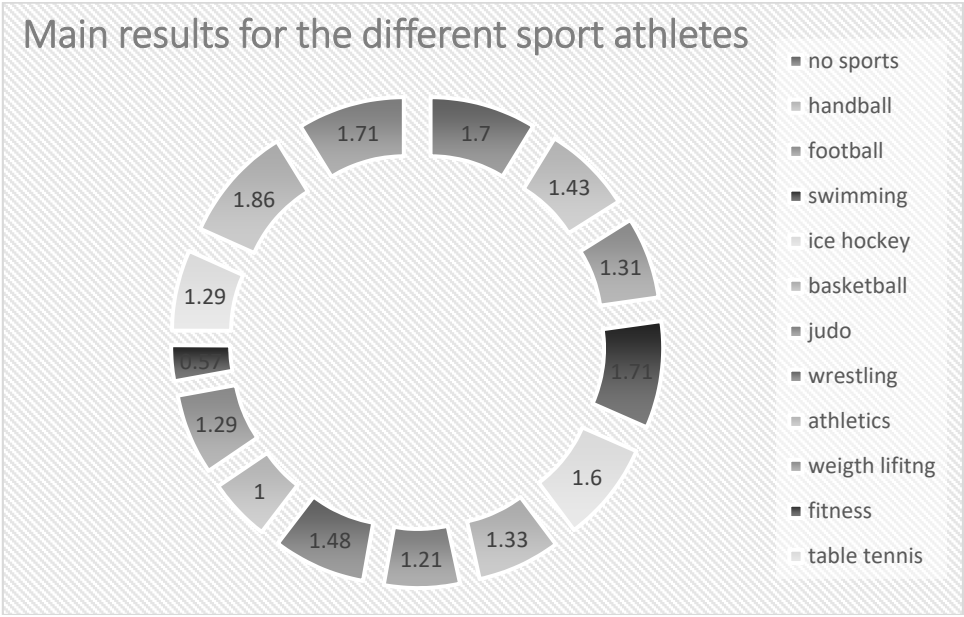

Fig. 7. The main results obtained by the athletes of the study

Analizing this diagram, we can observe, that from 13 different athletes, 7 realized a better result than the average, that means 1.425 points, in this case the standard deviation of the group is σ=0.371, that means that the group is significant unitary.

Best perform the sport dance with 1.85 point, because the balance skills and the ability to transfere the body weigth from one leg to other (one of the main skill in dance too). The others with a good performance are the handball (1.42), swimming (1.71), ice hockey (1.62), wrestling (1.47), triathlon (1.71) and not in the end the subjects who did not practice any sport activities with 1.69 point. In their case we think that the good result is given by the lack of the "bypass" between the other sport skills and ski.

Under the average value are situated the following sport athletes, football (1.30), basketball (1.32), judo (1.21), weigth lifting and table tennis (1.28), athletics (1.00) and fitness (0.58). These results are explained with the interference between the sports, couples of them as weigth lifting or judo requires a stiff body posture or the other athletes as basketball players they have the center of body weigth in a high position and it is disadvantage in their cases.

Conclusions

In our research the presumptions have been proven, because athletes, which did similar sports before, performed similar, got almost similar point in our test, meaning there were little differences between their results, compared to students with different sport past. This is because all the athletes doing one sport have got similar physical conditions, with similar motor skills and promptitudes.

As example we would like to mention the hockey players results on their posture, from the 5 sportsmen 4 scored one point, and only one of them got 2 points for that. In this case we recognized a general mistake, as all of them applied the stance used in hockey, which means big fork, circled legs and their bias was very low. All of the students used this in ski as well, and this was the reason they didn't get the highest score. Apart from that, in the beginning teaching them was the easiest from all of the students, because they were not afraid of the fact that the ski is slipping on the snow, their sense of balance was excellent, the only thing we couldn't manage was their posture.

Regarding the football player, our opinion is, that in the begging for all of them was very hard to learn how to ski, because they were not used to the fact that the snow is slippery. On the other hand, due the fact that in football running is the general motion, their bias was too high for skiing. Because of that, the subjects would not descend, lost their sense of balance and fall. It follows, that in springs their result were mixt, but most of the students got 1 point for that, because they found really hard the perfect position for balance, and if it was too high they couldn't spring in the perfect way.

Due their psysical abilities the students with basketball background performed really bad on the snow, their average result is 1.32. Their low score is in consequence of their height, as we are talking about really high sportsmen, their bias is too high. Because of that they were very instable, and they were afraid of skiing, which led to their arrear in learning the technical elements. Their points reflect this statement as well, as except of one student, all of the basketball players got 0 or 1 point for the last three technical element.

The student with combat sport background (judo, boxing) got similar results. Teaching them was very similar, almost identical, because they used a very safe posture, which was stable, but very combative as well. On the other hand, it was a very positive experience, that they were not afraid of doing the exercises. Their motion was very convulsive, and bitty, due their muscular body composition: with big muscle mass it is harder to perform fine movements.

We can classify in the same category the student with weightlifting background, because of his muscles he couldn't learn the technical elements.

The student with sports background, where the endurance and the concordance between the leg and arm is very important, like triathlon, swimming, dance, performed the best during our test. The triathlete and swimmer got identical point, 1.71 in average, the dancer got 1.85 points in average. In our opinion, the dancer performed the best in our test, because its leg-arm coordination was the best, and that is a very important element in skiing. Working with these sportsmen was the easiest for us, because they had a sense for this sport, they learned very fast, it seemed like they skied before.

The students with athletic sports and fitness background got the lowest scores: the student who did athletic sports got one point in average, and the student with fitness background got 0.57. The athletes problem was, that she had no staying power, she couldn't stand the classes, and couldn't develop very fast. The fitness girl was too rigid, inflexible, which led to the fact, that she learned every element very hard.

And last, but not least let's talk about the students with no sport background. To work with these students was very easy, because they had no learned motions, movements, they did everything as we said. Their development was constant, they were brave and loose. Their results are above average, their average score is 1.69. We thought they will not get such high scores, but they performance overpassed my expectations.

Finaly, the standard deviation of the results what the subjects obtained at the end of the parctises, with the statistic data, σ=0.371 let us to the conclusion, that the learning proceess was successful, and the most of the participants learnd the skills of skiing in a propper limit, just a view cases wich is not significant realised weak achivements.

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