

# The Importance of Research-Based Data for Design of Sport Intervention Programmes for Children

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## Abstract

*Over the last twenty years, rapid changes in the lifestyles of children and adolescents have been observed worldwide. Studies of secular changes show that changes in the lifestyles of children and adolescents in developed countries are manifested in an increased amount of subcutaneous fat, in a higher proportion of overweight population and in deterioration of their motor performance, particularly endurance and strength. Poor physical fitness of children and youth is associated with many preventable diseases and poses a serious current and future public health problem. Regular and quality physical activity (PA) during childhood can lead to improvements in numerous physiological and morphological variables in children and youth. Therefore, school-based PA interventions are important in improvements of PA level of children and their outcomes. One of PA intervention programmes started in Slovenia in September 2014. Recently, this intervention has been offered to schoolchildren between the ages of 10 and 12. Studies of physical development of children aged 10-12 have revealed that the proportion of overweight and obese children in Slovenia has been increasing, particularly in this age group, and that physical fitness of these children has been decreasing even more than amongst adolescent youth. Such school-based PA intervention can significantly influence the physical fitness of children. Therefore, the concept of design of new PA intervention programme, grounded on research-based data, is presented to show that the planning of such intervention programme should be based on research evidence and experience, should include modern approaches to the programme content and its implementation, should be organizationally well designed and should also be implemented by professional, competent teachers.*

**Key words:** *concept; intervention programme; prepubertal children; primary school; sport.*

## Introduction

Nowadays the lives of people in developed countries are mostly a reflection of the modern information era. Media and information technology, which offer easy and immediate fulfilment of human needs for entertainment and communication, are important features of their lifestyles (Pušnik & Starc, 2008). These extensive changes in the lifestyle of people have also influenced the physical development of children and youth (Armstrong, 2007; Ferreira et al., 2007). Poor physical fitness of children and youth is associated with many preventable diseases and presents a serious current and future public health threat (Bratina et al., 2011; WHO, 2007). Regular and quality PA during childhood is one part of the equation (quality nutrition being the other) that can lead to improvements in numerous physiological and morphological variables in children and youth (Bratina et al., 2011; Owen et al., 2010). Therefore, in developed countries interventions have been implemented that focus on changing PA levels and dietary intake (Brown & Summerbell, 2009; Camacho-Minano, LaVoi, & Barr-Anderson, 2011; De Meester, van Lenthe, Spittaels, Lien, & De Bourdeaudhuij, 2009; Dobbins, De Corby, Robeson, Husson, & Tirilis, 2009; Kriemler et al., 2011; Salmon, Booth, Phongsavan, Murphy, & Timperio, 2007; Shaya, Flores, Gbarayor, & Wang, 2008).

Schools have been a popular setting for implementation of such interventions, as they offer continuous, intensive contact with children. School infrastructure and physical environment, policies, curricula and staff have the potential to influence children's health in a positive way (European Parliament resolution on the role of sport in education, 2007; Ortega, Ruiz, Castillo, & Sjostrom, 2008; Sasaki, Shindo, Tanaka, Ando, & Arakawa, 1987). Appropriate PA helps pupils develop conscious control in execution of body positions and movements, thus forming a correct body posture (Fairclough & Stratton, 2005); develop motor coordination, endurance, strength, speed and flexibility (Armstrong, 2007; Jurak, Cooper, Leskošek, & Kovač, 2013); regulate body mass and skinfold thicknesses efficiently (Armstrong, 2007; Jurak, Cooper et al., 2013) and contribute to the building of bone mass (Barbeau et al., 2007).

Most of PA interventions are based on Physical Education (PE) classes (De Meester et al., 2009; Salmon et al., 2007) where the main part of children's PA is presently implemented (Bailey, 2006). PE classes have a purpose to prepare students to be physically educated persons: to teach them the importance of regular PA for health and to build skills that support active lifestyles (Ding, Sallis, Kerr, Lee, & Rosenberg, 2011; Fairclough & Stratton, 2005; Froberg & Andersen, 2010; Sallis, Prochaska, & Taylor, 2000), representing one of the most important developmental tasks in childhood and youth (Hardman, 2008; Sallis et al., 2000; Strong et al., 2005). In addition, the fact that motor development and physical fitness are closely related to cognitive, emotional and social areas of a child's development (Kovač & Strel, 2000; Sibley & Etnier, 2003; Tomporowski, 2003) should not be disregarded. Due to the ever increasing amount

of free time spent indoors and in front of TV screens, it is particularly important that as much as possible of such PA is organized in nature and outdoors.

One of PA intervention programmes started in Slovenia in September 2014 and recently, this intervention programme has been offered to schoolchildren between the ages of 10 and 12. Studies of physical development of children aged 10-12 have revealed that the proportion of overweight and obese children in Slovenia has been increasing particularly in this age group and that the physical fitness of these children has been decreasing even more than amongst adolescent youth. The design concept of new PA intervention programme, grounded on research-based data, is presented to show that the planning of such intervention programme should be based on research evidence and experience, should include modern approaches to the programme content and its implementation, should be organizationally well designed and that it should also be implemented by professional, competent teachers.

## **Organisation Approach**

In Slovenian schools, pupils between the ages of 10 and 12 have three compulsory PE lessons per week. Schools can also offer a special intervention programme Healthy lifestyle (additional two PE lessons per week, free of charge and taught by PE teachers). Since September 2014, pupils of this age have also been able to choose to participate in one additional non-compulsory elective Sport subject a week.

### ***What Are Non-Compulsory Elective Subjects and How Do They Fit into the Primary School Curriculum?***

Elective subjects form a part of the Slovenian primary school curriculum. Pupils are able to choose elective subjects by themselves according to their interests, wishes and abilities. In the second educational cycle (10 to 12 years of age), pupils can choose between five different subjects: second foreign language (two lessons per week), art, computers, sports or technique (one lesson per week). Pupils can, with the permission obtained from their parents and according to the timetable, choose two to three lessons of non-compulsory elective subjects per week (Primary school timetable, 2014).

### ***Gradual Introduction of Elective Subjects in Schools***

In accordance with Article 22 of the Law on the changes of the Law on Primary school (13), elective subjects were gradually introduced in the second educational cycle in the academic year 2014/15. They will be available to pupils in Year 4 in 2014/15, to pupils in Years 4 and 5 in 2015/16 and to all pupils in Years 4, 5 and 6 in the academic year 2016/17.

### ***Optional to Choose and Compulsory to Attend***

In the second educational cycle pupils can choose the same subjects in all three years as well as in two or one year only, whilst choosing another elective subject in the following year. It is also possible for pupils in individual year not to choose any subjects

at all. When a pupil chooses a certain subject, the attendance becomes compulsory in that academic year. His/her knowledge is evaluated and the mark is listed in the end of year report card.

## **Expert Starting Points for the Preparation of Non-Compulsory Sport Subject Have to Be Based on Thorough Research Data about the Characteristics of Population**

The design of every subject has to be based on characteristics and basic needs of the population for which the subject is intended, on social goals that need to be fulfilled with the subject as well as on given possibilities, such as the number of lessons, professional workforce, material conditions for programme implementation, etc. (Kovač et al., 2011).

With the idea for the preparation of non-compulsory elective Sport subject, first the starting points and subject concept had to be prepared. The questions at the time were:

- What are the developmental characteristics and needs of pupils at that age?
- What is the status of physical and motor development of pupils at that age, what are the reasons for such status and how can it be improved?
- What is the motivation of these pupils?
- What are the conditions for implementation of this subject (how many lessons per week will be available for the subject, what facilities will the teachers be able to use, how many children will there be in a class, what is the equipment of schools)?
- Who will teach the subject and what skills and competences should the teachers who will teach the subject have?

### ***Characteristics and Needs of Pupils at That Age***

The basic characteristics of biological development of children in the second educational cycle are the beginning of intensive muscle growth, higher developmental level of motor coordination which enables acquisition of complex motor structures, sufficiently high motivation for PA and excess of body energy due to the passive motor load in school, which can be successfully released in PA. As a result, this age period is suitable for learning more complex motor patterns which serve as a basis for the development of motor intelligence in individual pupils and contribute to the motor competence of pupils significantly. An appropriate intellectual development for understanding group instructions and social development for forming relationships with peers allow the teachers to use more demanding organizational forms. There are no significant differences in motor efficiency between the genders; moreover, these differences have been decreasing in the last decades as girls are becoming more similar to boys in motor efficiency (Strel, Starc, Jurak, & Kovač, 2012).

During regular PE lessons in the second educational cycle pupils acquire basic sports skills from athletics, gymnastics, dancing and team sports. Additionally, they should

all master the swimming technique. The basic content of the regular PE curriculum should be upgraded to include a non-compulsory elective subject Sport. It should be done mainly in such a way that the content, which should be present in everyday PA due to the importance of its effect on children's development (running, jumping, climbing, acrobatic skills, endurance, etc.), is supplemented with the new content, which will be interesting to pupils. Both groups of content should be presented in a different way. Namely, the main aims are not learning the techniques, but achieving positive effects on motor efficiency with adequate intensity of exercise, thus also influencing health factors.

### ***Status of Physical and Motor Development of Pupils at That Age and the Reasons for Such Status***

The monitoring of physical and motor development of children in Slovenia, which has been carried out for many years within two studies (SLOfit system and ARTOS) (Jurak, Kovač, & Starc, 2013; Strel et al., 2007; Strel et al., 2012) revealed important changes in physical characteristics of children between the ages of 10 and 12.

A comparison of SLOfit results for years 1990 to 2010 showed the following (Strel et al., 2012):

- 10-year-old boys have, on average, become 1.9 cm taller, 3.9 kg heavier and have gained 2.8 mm of triceps skinfold thickness; 11-year-old boys have, on average, become 2.3 cm taller, 4.8 kg heavier and have gained 2.9 mm of triceps skinfold thickness; 12-year-old boys are on average 2.7 cm taller, 5.5 kg heavier, and have gained 2.7 mm of triceps skinfold thickness;
- 10-year-old girls have become, on average, 1.7 cm taller, 3.4 kg heavier, and have gained 2.5 mm of triceps skinfold thickness; 11-year-old girls have, on average, become 2.0 cm taller, 3.7 kg heavier and have gained 2.3 mm of triceps skinfold thickness; 12-year-old girls are on average 2.0 cm taller, 4.2 kg heavier, and have gained 2.2 mm of triceps skinfold thickness.

Among the primary school population the increase in the proportion of overweight and obese children has, in the twenty-year period, become largest in children aged 10 to 12 (Kovač, Jurak, & Leskošek, 2012):

- between 1991 and 2011, the proportion of overweight and obese 10-year-old boys increased from 16.9% to 29.3%, of 11-year-old boys from 16% to 31.3% and of 12-year-old boys from 17.1% to 31.4%. For comparison, the increase in the proportion of overweight 7-year-old boys was from 15.6% to 21.6% and of 14-year-old boys from 14.4% to 27.2% (Kovač et al., 2012);
- between 1991 and 2011, the proportion of overweight and obese 10-year-old girls increased from 16.2% to 26.8%, of 11-year-old girls from 15.2% to 26.9% and of 12-year-old girls from 15.2% to 25.0%. For comparison, the increase in the proportion of overweight 7-year-old girls was from 16.4% to 22.4% and of 14-year-old girls from 13.1% to 20.9% (Kovač et al., 2012).

In this age group, there has been a noticeable decrease in motor efficiency, mostly endurance, shoulder and arm strength, flexibility and explosive power (Strel et al., 2012). For example, a comparison of SLOfit results between 1990 and 2010 (Strel et al., 2012) revealed:

- an increase of 12.5 seconds in 600-metre run results for 10-year-old boys, 12.9 seconds for 11-year-old boys and 12.7 seconds for 12-year-old boys;
- an increase of 9.8 seconds in 600-metre run results for 10-year-old girls, 10.3 seconds for 11-year-old girls and 11.1 seconds for 12-year-old girls;
- a decrease of 10.2 seconds in a bent arm hang for 10-year-old boys, 10.1 seconds for 11-year-old boys and 10.6 seconds for 12-year-old boys;
- a decrease of 2.9 seconds in a bent arm hang for 10-year-old girls, 1.2 seconds for 11-year-old girls and 1.6 seconds for 12-year-old girls.

A decrease in motor abilities is larger for boys than for girls (Strel et al., 2012). The data of SLOfit results between 1990 and 2010 revealed that:

- a difference between boys and girls in 600-metre run results in 1990 was in favour of boys by 11.4 seconds among 10-year-old children, 10.3 seconds among 11-year-old children and 10.5 seconds among 12-year-old children. This difference decreased by 2010 to 8.7 seconds in favour of boys among 10-year-old children, 7.1 seconds among 11-year-old children and 8.9 seconds among 12-year-old children;
- a difference between boys and girls in bent arm hang results decreased from 12.1 to 4.8 seconds among 10-year-old children, from 11.5 to 2.6 seconds among 11-year-old children and from 11.8 to 2.8 seconds among 12-year-old children.

In this age group the proportion of less competent children in terms of motor skills has doubled in the last twenty years (from 5.3% to 11.8% in boys and from 5.9% to 9.7% in girls) (Strel et al., 2012).

According to the collected data, it can be concluded that the children in this age group are the most vulnerable population to the occurrence of modern day diseases.

The data from various studies show that the reasons for such situation can be found mainly in an inappropriate lifestyle of children at this age, which is manifested in the unsuitable quantity and quality of food and poor eating habits (Brown & Summerbell, 2009; Kovač et al., 2013; Shaya et al., 2008); an excessive amount of time spent sitting and an inadequate amount of time intended for various physical activities (Froberg & Andersen, 2010); an inadequate amount of free-time PA (Dobbins et al., 2009); inadequate intensity of PA (Aaron, 1993; Armstrong, 2007; Froberg & Andersen, 2010); less suitable types of exercising (Aaron, 1993; Hardman, 2008) and also insufficient competences of teachers teaching PE at this age to reduce the consequences of unhealthy lifestyle merely through PE lessons (Jurak, Cooper et al., 2013; Starc & Strel, 2012).

## **Conceptual Starting Points for Curriculum Planning**

According to the needs of children at that age, as well as their physical and motor development, the basic starting points for setting the concepts of the subjects were:

- encouragement of active lifestyle with a selection of content which children can perform themselves in their free time;
- development of those motor abilities which are crucial at that age (coordination of movement, endurance, strength, speed, balance and flexibility) and where a decrease has been noticed in the last twenty years;
- selection of such types of exercises which can contribute to the regulation of body mass and the amount of skinfold thickness (emphasis on endurance activities);
- influencing the body posture by including the content which requires conscious control whilst executing positions and movement;
- influencing suitable bone mass construction (inclusion of jumps);
- acquisition of motor competences (variety of more complex motor structures);
- interesting content;
- a possibility for performing PA outdoors as often as possible (thus influencing immune resistance of children);
- a possibility to implement the subject content with adapted learning equipment.

The selection of interesting content, good organization of lessons by the teacher and appropriate pedagogical approach enable the children to experience effects of various motor activities on their health and to understand the importance of physical and mental relaxation whilst acquiring suitable social skills by working in a group. The growing mission of expertly led physical exercise is also the formation of basic values, such as patience, solidarity, cooperation, responsibility, diligence, self-control, discipline, respect for rules, honesty, critical thinking, foreseeing the consequences of one's own actions and attitude towards nature. Children should gain self-confidence through a process in which the teacher should place an emphasis on the fact that progress depends on effort. In addition, in this way children will learn to evaluate their own skills and limitations, which will lead to better understanding and respect for differences among people.

### ***Selection and Realization of Content***

On the basis of good understanding of the status of children and their needs, teacher defines the goals of lessons and selects the appropriate content, which could include:

- upgrading of content which should, due to its effect on physical and motor development of children, be present in everyday PA and can be acquired already in the first educational cycle (running, jumping, climbing, acrobatic skills, etc.). It is also included in regular PE lessons;
- new skills, which are not a part of PE curriculum, but form an important part of free-time PA in children whilst being important from the point of view of sports-

recreational effects on quality spending of free time also in later stages of life (e.g. Nordic walking, in-line skating, racquet games).

According to the goals of intervention programme, the content has been divided into three segments:

- sports activities influencing mainly the development of motor coordination, balance and precision and encouraging creativity in children (dancing, hockey games, racquet and ball games, circus skills, balancing skills, target practice, in-line skating);
- sports activities developing mostly general (aerobic) endurance (running, winter activities, Nordic walking and running, swimming and other water activities, aerobics, cycling);
- sports activities developing various forms of strength (acrobatics, jumping, climbing, combat sports).

In this way a non-compulsory elective subject complements regular PE lessons and together they represent an enriched unity and an important encouragement for the formation of active lifestyle in pupils.

## **Didactic Recommendations**

The teacher allocates each segment a third of time and selects the content and time spent within individual segments optionally (at least two or more types of content). Nevertheless, content should be selected with an aim of fulfilling previously set goals, which depends on the needs of children. For example:

- individual segment can include more emphasis on two activities only or by equally dividing time between more activities;
- different types of content can be focused on in various age groups (e.g. in the third segment for Year 4 climbing and wrestling games, in Year 5 jumping and combat games, in Year 6 acrobatics and climbing).

Flexibility development should be practiced at the beginning or at the end of each lesson.

When teaching, emphasis should be placed on those didactic approaches which include:

- enjoyment,
- cross-curricular approaches,
- cooperation and project work,
- problem solving learning,
- introduction of personal portfolio of pupils,
- inclusion of ICT.

## **Organisational Design**

The teacher will face mixed groups in terms of age and gender. As a result, lessons should be appropriately differentiated. When the interest is large, groups can be formed according to age or gender.



Lessons should be held once a week. Joining lessons is possible only in some activities, such as winter activities. However, this should be an exception rather than a rule.

In order to build an immune system of children, as many activities as possible should be practiced outdoors. It is important for pupils to have adequate clothing and footwear.

Modified equipment should be used in exercising (various targets, homemade balls). Games should have modified rules in order to influence the cooperation of all pupils, formation of positive self-image and friendly relationship among them.

## **Standards, Minimum Standards and Evaluation**

Since there is no ideal knowledge in sport and exercising, but rather finding an efficient movement that is adapted to characteristics of an individual, the teachers should set individual goals for children.

At the beginning of the academic year, the teacher should set a standard of knowledge for each individual child and explain the evaluation criteria. Teachers should mainly evaluate the implementation of skills in real life circumstances (e.g. with the use of personal portfolio pupils should explain how they could improve their own skills or abilities).

## **What Kind of Knowledge and Competences are Required from a Teacher in Order to Prepare a Quality Programme**

In order to prepare an efficient programme, a teacher should understand:

- recommendation about PA intended for this age group;
- basic characteristics of biological development in children (growth curve and spurt, proportion between height, weight and muscle strength);
- ways to develop motor abilities in this age group (when it is most efficient, which content and what intensity);
- characteristics of motor learning, particularly for more complex motor patterns;
- biomechanical aspects of movement realization according to the changes in puberty;
- conceptual selection of content;
- technique of individual motor structures and their adaptation to the abilities of children, material conditions of school and sports equipment;
- appropriate methodological procedures;
- appropriate help and support for safe performance of activities;
- efficient use of modern didactic approaches and ICT tools;
- appropriate ways of presenting the theoretical content.

## **Conclusion**

Recently, PA has been assuming an increasingly more important role in the formation of healthy lifestyle of the individual, particularly during a growing-up

period (Aaron, 1993; Kesaniemi, Riddoch, Reeder, Blair, & Sorensen, T., 2010; Sallis et al., 2000; Trudeau & Shephard, 2005). Changes noticed in the lifestyle of children require conceptual changes of the curricula and new setting of goals, which should be directed more at broad lifelong education about the active lifestyle and particularly at social and personal development of the individual (Hardman, 2008; Kovač et al., 2011). This requires changes in the understanding of the role of sports content; it should be presented within the framework of pedagogical contexts, meaning that it represents only the means for achieving the goals of curricula and is not the goal itself. More emphasis should be placed on the autonomy of school and teachers when forming school syllabi. Only then will the teachers, children and youth be given back a certain amount of freedom to decide autonomously about the sports activity they would like to participate in. Their decisions will not be based on external factors to such a great extent.

The main point of the proposed intervention programme, which is based on the data collected throughout the regular monitoring of physical and motor development of children, is a concept which states that nowadays, when we are searching for the main purpose of PA, health should be placed above (or at least as high as) enjoyment. This concept should be based on changes in thinking and should become a challenge for teachers. Programmes for various groups of children should be designed very carefully in order not to be misunderstood. Sport should firstly still remain fun, but only as a result of the planned, expert and very creative work of teachers. Therefore, it is very important who teaches the subject, what kind of programme will be prepared and how it will be implemented.

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# Važnost rezultata dosadašnjih istraživanja za kreiranje interventnih sportskih programa za djecu

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## Sažetak

Posljednjih dvadeset godina brze promjene u životima djece i adolescenata zapažene su na globalnoj razini. Istraživanja svjetovnih promjena pokazala su da se životni stil djece i adolescenata u razvijenim zemljama manifestira povećanjem potkožne masnoće, u većoj proporciji pretilog stanovništva, kao i u pogoršanju njihovih motoričkih postignuća, poglavito izdržljivosti i snage. Slaba fizička spremnost djece i mladih povezuje se s mnogim preventivnim bolestima te predstavlja ozbiljan trenutni i budući javno-zdravstveni problem. Redovna i kvalitetna fizička aktivnost (PA) u djetinjstvu može dovesti do poboljšanja u mnogim fiziološkim i morfološkim varijablama djece i mladih. Prema tome, intervencije kod školske FA važne su kod poboljšanja razina FA djece i njihovih ishoda. Jedan interventni program FA započeo je u Sloveniji u rujnu 2014. Nedavno je taj interventni program ponuđen školskoj djeci u dobi između 9 i 12 godina. Istraživanja vezana uz fizički razvoj djece u dobi od 9 do 12 godina upućuju na to da je proporcija pretila i gojazna djece u Sloveniji u porastu posebno u navedenoj dobnoj skupini te da je fizička spremnost djece u navedenoj skupini u opadanju čak više nego među mladim adolescentima. Takva školska intervencija FA može značajno utjecati na fizičku spremnost djece. Prema tome, koncept nacрта novog interventnog programa FA, utemeljen na rezultatima istraživanja, prikazuje se kako bi pokazao da planiranje interventnog programa treba biti utemeljeno na dokazima istraživanja i iskustva, da treba uključivati moderne pristupe sadržaju programa i njegovu ishođenju, organizacijski dobro strukturiran pa ga trebaju izvoditi profesionalno kompetentni nastavnici.

**Ključne riječi:** djece u pretpubertetu; koncept; osnovna škola; program intervencije; sport.