REVIEW PAPER

Health-related values of outdoor physical education. Leading concepts and transitions in polish schools throughout 20 years (1986–2006)

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

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Abstract

Transitions that have taken place in Polish schools for many years are aimed at taking its real functions nearer to the assumptions. The results of author's research and effects of the concept of outdoor physical education popular in Western countries prove a variety of health-related advantages on the scale of both an individual and the society. As recently as at the end of the past century, only 40–50% of students in Polish schools participated in outdoor activities. Sadly, this number dropped to 10–15% now while physical education is almost exclusively associated with gymnasiums. Health-related needs among students are very big and invariably topical. Modern physical education and individual physical activity are able to rise to this challenge. One of the most fundamental measures of this modernity is ability to make use of the resources of the natural environment through regular physical exercise.

Key words: physical education • health-related fitness • core curriculum • outdoor physical activity

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Background

Transitions in Polish school system that have taken place for many years are aimed at taking its real function nearer to the assumptions. The subjects (of education) which are on the lookout for their identity in contemporary school (not only in Poland) include **physical education**. Actual effects of physical education are still far from the assumed. This happens despite formally implemented beneficial legislation transitions (3–4 classes a week, possibility of using author's didactic and organizational solutions, increasingly popular option to select the type of physical activity by the students), clear improvement in the infrastructure for physical education and higher formal competence among the teaching staffs. The reasons for dissonance between the actual effect and the assumptions include, among other things, teleological (concerning purpose) inconsistency, excessive expectations, impact of the models of consumerist lifestyles (departure from gymnasiums), intraschool isolation of physical education, lack of monitoring of the effects of education.

The goals of physical education result from its orientation. Orientation is subject to slow but continuous evolution. The most general approach is that it underwent, throughout two centuries of its history, from physical education developed by Piramowicz in the form school recreation [1] and theoretical basis by Śniadecki [2], such stages as: gymnastics-based Sokol movement with Jordan playgrounds, defence assumptions of physical education during interwar period [3], through period of copying of sports ideas from USSR ("be fit for working and defence") to increasingly popular current **health-related fitness**. This orientation mainly based on the experience and output of sports science and sport medicine [4–6] is typically focused on health goals. In practice of Polish schools, health-related goals of physical

Physical education – a process of emotional and practical formation of physically active lifestyles, based on awareness and fulfilment of developmental and health-related human needs by means of physical education.

Health-related fitness – physical activity oriented towards improvement in endurance and cardiorespiratory fitness in consideration of prevention of illnesses resulting from limited physical activity.

education are still competitive in relation to fitness-related and sport-related goals. It seems that its worth doing anything to identify health-related assumptions, as major ones, with school physical education (which is according to the new core curricula being in force in Polish schools since 1 September 2009).

Another reason for dissonance between the real and the assumed functions of physical education, besides teleological inconsistence, is excessive expectations of physical education. Since movement-related classes in schools are of little intensity and low frequency (excessive number of sick leave certificates) it is difficult to expect that they have a significant impact on e.g. physical development of students [7] and considerable improvement in endurance and physical fitness among students, being positive measures of health. According to M. Demel, contemporary classes in the form of 'movement episodes' are often what seems to pretend to be P.E. classes. If we add that they typically take place indoors, it has nothing to do with the training which contemporary students need [8].

Third reason includes widespread influence of consumerist lifestyles with specific 'physical passivity syndrome' [9]. This style is based on extreme limitation of physical activity, staying indoors (hence preference for gymnasiums) and constant nervous excitement. Physical activity performed several times a week by many students, similarly to their parents or teachers is actually redundant whereas intensive activity outdoors is often accepted by consumers of contemporary wellness only as a therapeutic necessity recommended by the doctor.

Physical passivity observed among both children and adults causes that physical education in schools appears to be a system of outdated assumptions and behaviour patterns. Hence isolation of this subject can be seen at schools. The neglected problems at schools include: participation of students in P.E. lessons, location, content and the form of classes, effects of teaching, cooperation with parents. Problems of physical education are often noticed during sport success achieved by a handful of selected, most physically fit students or during accidents connected with physical activity, which typically attract interest of media, even of national scope. This specific isolation of problems of physical education in contemporary schools is deepened by lack of a monitoring of the effects. Physical activity has not been a subject of any evaluation for many years, be it intraschool or extraschool one. Tests for assessment of competence level among students after each stage of education do not include physical education achievements, which reflect a particular anomy in this domain.

This is also caused by perception of physical education in schools as a slightly 'infantile offer' for students. This is why, independently of critical approach to dissonance between the assumed and the real effects of contemporary physical education, it is worth to rethink, in consideration of the approach of physical education of the 21st century, the types of effects of physical education and their conditionings. According to different authors, the following effects are typically observed: fitness-related, motor-related, endurance, educational, didactical, cognitive, emotional, behavioural and health-related effects. However, the assessed aspects of physical education mainly include those which are the effects of intensity and frequency of classes and acquired motor abilities or knowledge in this field. Very rarely, mainly due to practical differences, those aspects are evaluated which are the effect of emotional involvement of students and the location of physical education classes. This happens because it is difficult to take objective measurement of physical activity and to find differences in effects of lessons learnt in gymnasiums or outdoors. However, the awareness of the effect of these conditions should be widespread, especially among teachers. Emotional involvement and identification with physical education goals, both for students as well as teachers and parents, besides the locations (gymnasiums, outdoors) are a necessity, especially with preference of health-related qualities of physical education. Therefore, health-related values of physical education, analysed principally in the aspect of location of these activities throughout many years and in consideration of leading world concepts, are the focus of this paper. The authors recognise that the best orientation for physical education in the 21st century is health-related fitness. Location is of essential importance to this orientation since classes outdoors differ from indoor activities (or those performed in substitute rooms) with a number of factors which impact on students' health. The results of author's investigations and studies by other authors, which confirm these statements, are preceded in the present paper with the description of leading world-scale outdoor concepts of physical activity.

Western concept of outdoor physical activity [10]

A. Education through contact with wildlife (New Zealand, Australia)

The longest and the most original experience with so-called 'education outside the classroom' were developed by New Zealand. In 1849, Robert Huntley established a school with outdoor activities for boys. After a century, the assumptions of that school were refreshed. J. R. Hughes, inspector of outdoor education in New Zealand, who wrote about education outside the classroom, emphasized that they include a range of activities

outside schools: touristic, recreational, sport, survival, nature, ethnographic, plastic, drama and other activities. They are performed near schools, or in 'field centres', or else in typical cottages or huts, spread around the whole country. The activities are supervised by professional teachers and coaches or by ordinary teachers. Since the educational reforms in 1988, a part of public schools have experienced problems with financing of outdoor activities. Before, these activities were supported by the government.

Goals of outdoor education [11]:
- enrich classes with joy and adventures, which corresponds to students' needs,
- support development of personality and social development,
- create opportunities to form interpersonal relationships in different environments,
- understand values of natural environment and ethnic groups,
- teach utilitarian behaviour on different occasions,
- teach how to face the unexpected, adventure and be prepared for hardship,
- provide opportunities of aesthetic experience, development, sensitivity.

Outdoor education differs in time share for different schools (which depends, among other things, on financial resources). Educational authorities strive for employing, in field centres, even in some cottages/huts, qualified coaches, paid from budgetary finances. Cascade system of outdoor education was organized. Each older student, who underwent a number of stages in this education, organizes activities for eight younger schoolmates from the nearest environment. New Zealand's experience reaches even further. Easier forms of outdoor education for the disabled are also organized. They provide an opportunity of coping with very difficult situations, enriching their lives and integration with other, physically healthy friends. They also are one of the best ways to develop personality for the latter [12,13].

Australia, which copies its neighbour and wants to secure implementation of outdoor education for the near future, organizes trainings for staffs. This is carried out by Chevalier College in New South Wales. Long-term courses for students and teachers have been organized for 25 years to prepare them to work on outdoor education with children, starting from as early as eight-year-old children. The courses adopted a variety of names: Wilderness Studies, Wilderness Leadership, Wilderness Expeditioning, thus including a variety of modifications of contact with 'wild nature'. The College also reports that it has also been providing training for some time within so-called Mountain School and preparing for working with children for eight years (Introduction to Wilderness). Classes are of theoretical and practical nature. Practical classes are held during weekends and 4, 5, 6-day camps and also during a few days 'Test Expeditions' (survival-oriented meeting wildlife). Examples of activities: night expedition supervised by the instructor, climbing twenty-meter-high mountain wall, water obstacle crossing, white-water canoeing, sailing, preparation of the camping for several nights, six-hour long trekking etc. [14].

Outdoor activities in New Zealand and Australia originate with Maori customs. They do not have a therapeutic nature influenced by civilization but they are rather a natural school of life under difficult conditions.

B. Adventure education in different terrain conditions (England and Canada)

English models of outdoor and adventure education are of more compensational nature against the effect of civilization, although some elements of recognition and protecting the natural environment or copying the nature have also been preserved here [15–20]. There are three fundamental principles of field activities: enjoyment – safety – challenge.

In the broadest sense, this education encompasses three areas: *outdoor pursuits* (activities with a variety of movement-related, adventurous and difficult field tasks, coping with different situations); *outdoor studies* (different forms of education in the field of culture, architecture, society or nature, based on observation, interaction and coping with changeable situation, acclimatization to new conditions and difficulties, recognition of the nature using all the senses, love for the environment etc.); *residential element* (learning to cooperate and co-work as well as formation of attitudes towards overcoming difficulties together).

Outdoor education, according to English authors, is an interdisciplinary concept focused on teaching all the aspects: predicting, calculation and thinking, avoiding mistakes through teamwork, use of knowledge, tolerance, interpersonal help and right decision-making. Physical education, with 10% of school time for outdoor education, is being widely extended (not included in the mentioned 10% due to the fact that it provides opportunity of integrated education for a number of subject at the same time). Local centres of outdoor education were established to make it easier to organize so-called 'outdoor weeks' according to the principle of: twice in the mountains outside the county and once at the seaside within the school year. Example curriculum to be used by outdoor week organizers for older students [17]:

(I) *Survival Swimming*: water safety and rescue, water games, water adventures. It begins in indoor swimming pool and, after getting lifeguard certificates, it is continued in outdoor reservoirs and at the seaside.
(II) *Camping*: using backpacks, tents, organization and preparation of the routes, building shelters, ensuring warmth in the night and in winter. Training at schools and then practice on gradually longer and more difficult routes.
(III) *Alpine*: skiing, climbing, water crossing in difficult mountain areas (rope bridges), rock climbing rescue.
(IV) *Water Sports*: canoeing, rowing, raft construction and use, sailing.
(V) *Orienteering*: health development exercises, care for cardiovascular development, footprint pursuit, treasure hunt, orienteering runs.
(VI) *Integrated Learning*: integrated outdoor education.
(VII) *Journeying*: travel & adventure, analysis of difficult routes (coast, mountains, upstream), preparation and crossing.

Similar solutions are used in the far north of Canada [21,22]. During long winters students participate in winter bivouacs, ice skating, sledging, snow sculpturing, winter orienteering, different forms of physical activity in deep snow and fishing in ice holes.

C. Recreational and educational contact with nature (Germany and France)

Germans prefer to combine field activities with school sports and environmental education. Famous for order and discipline, they go towards building of sports and recreation facilities with opportunity of close contact with nature near large cities. Recreational and adventure activities are performed in a rather sport-related manner whereas education and experiencing of the environment are hedged with detailed safety and protection regulations. Field activities are implemented within a number of off-school days, e.g. walking day, adventure day etc. Well-prepared week-long camps (there is also state-managed organization of such camps) are completed with a variety of trips and practical lessons of non-intervening life with the nature. After theoretical preparation using plant encyclopaedias, lists of rivers that should be kept off, but also learning how to behave in the nature (using dramas or simulation), students learn outdoors how to paddle without touching the water plants or river banks, how to communicate with other teams without making noise, specialist observation methods (watching nature) etc. This means learning at first hand [23]. Students participate in repairing the damaged nature, clean rivers, repair damaged river banks. Germans tend to change the concept of physical education towards the free body culture with creation of healthy outdoor sports.

Popularity of physical activities is also growing in France. It comes from both parents and children. However, France experiences some problems of staff and organization-related nature. In 1991, the decision was made about pilot combination of such activities with physical education. Ten regional education authorities in groups of ten schools made experiments in order to determine which activities should be led by which teachers. Outdoor activities have been held since 1993 in high schools in all forms, including last form. Eight specialities of outdoor activities were qualified: mountaineering, orienteering, canoeing, mountain biking, alpine skiing, cross-country skiing, sailing, scuba diving (coral reefs). Detailed curricula and recommendations were also prepared for these specialities. For instance, in regional education authority in Rouen (Normandy), preparation and execution of the curricula comprising 7 lessons 90 minutes each for beginners and 14 lessons 90 minutes each for advanced students is recommended, after initial gaining the experience and after field tests [24,25]. School outdoor activities in France follow the trends observed among the adults at weekends. They include outdoor recreational and sport activities which supplement physical education and are connected with learning and environmental protection. They are not directly connected with health-related goals.

D. Outdoor/environmental health-related education according to American patterns

Health-related goals as an overriding objective are a focus of American outdoor/environmental education. Their curricula are co-financed by schools, youth organizations, churches, nature centres and independent persons. Forests, parks and even national parks were made available. Media are popularizing special outdoor programs form a variety of social groups. The programs are consulted with scientists [4–6] assigned to supervise cardiovascular health. In 1985, the President's Commission on Americans Outdoors was established to prepare the report on the needs of citizens for outdoor experience as a prophylactic and therapeutic measure. Wildlife Agency was also established. It is being proved that contact with nature brings four categories of benefits: psychological, sociological as well as physical and health-related. It is necessary for the people of cities and business since it reduces the level of aggression, improves psychological health, simplifies social bonds and contact with others. The most important benefits can be observed in the form of physical and health-related advantages. They include: cardiovascular fitness

(endurance); orthopaedic fitness (strength and flexibility); maintenance of desired weight.

The courses for health educators [26–28] are also organized. Despite a lot of effort and extensive promotion, not all the schools implement outdoor education programs. Yet, more and more schools are extending their activities over these programs.

These pursuits in Western countries, leading to formation of several concepts of **outdoor physical activity**, provided the author inspiration for long-term studies on the effects of physical education carried out in gymnasiums and in Polish schools in the aspect of health values.

Health-related effects of physical education – theoretical fundamentals

Health-related effects of physical education mainly concern physical health of the students, understood according to Woynarowska [29] as a proper functioning of systems, organs and tissues, proper physical development and low level of risk factors, particularly those connected with physical education and insufficient activity, fitness and physical endurance as well as low resistance of the body to illness. In order to make the theory of health translate into physical education practice, let us use health monitoring as a task for public health i.e. maintaining and improvement of health among all the people, as physical education is one of the areas of public health [30]. Monitoring of public health takes three types of its measures into consideration. They include *negative measures:* mortality, incidence of disease, disability, illness-related absence; *indirect measures*: life and work conditions, sanitary conditions, water and air pollution, food quality and *positive measures*, which considerably relate to sports science. This is confirmed by literary output of numerous authors dealing with positive health measures [30–33]. Drabik [30] lists the following positive measures of health: quality and length of life, physical development, physical activity, physical fitness, physical endurance, heart rate (especially resting heart rate), blood pressure, body mass index, lipid profile, hematocrit and others. In author's personal opinion, assessment of the extent and the quality of the abovementioned phenomena, particularly activity, fitness and endurance as well as monitoring of heart rate and overall resistance of the body to illness within the physical education classes and periodically after certain educational cycles, means the evaluation of health-related effects of physical education. Classes with longer duration time and safe movement intensity and with improved physical fitness and endurance are characterized by enhanced health effect. With this approach to health effects, not only intensity, frequency and content of physical activity within physical education is important; the location of this activities is also essential. As confirmed by the further described investigations, open field with considerable space and additional (except for movement) health-related factors (climate and land factors) are becoming a place where health effects are more beneficial than effects of activities carried out indoors. Significant conditions for success of this form of activities is conscious, emotional involvement of students (and parents) and teachers in outdoor physical activity.

Core curriculum – a set of directives forming theoretical, axiological and teleological assumptions and practical indications for realization of the subject at the given level of school education.

Outdoor physical activity – according to the concept of English experts, this concept is interdisciplinary and concerns outdoor teaching of all the aspects: predicting, calculation and thinking, avoiding mistakes through teamwork, use of knowledge, tolerance, interpersonal help and right decision-making.

Health related values of physical education classes outdoors and indoors

The author has carried out the investigations twice. Their aim was to compare health-related effects of outdoor and indoor activities [10]. First investigations were carried out in 1986–1989, second one in 1995–1996. Both experiments were based on the method of natural pedagogical experiment and were carried out in elementary schools in Zamość Voivodeship. First experiment took three years while the other was a year long. First experiment covered the same students (n=407 in fourth class, n=285 in fifth class, n=169 in sixth class) for three years. The second one involved 227 students from classes 4–8 at the same time. The activities were carried out by the same physical education teachers according to the same didactical

Table 1. Heart rate in children from IV–VI class during lessons outdoors and in gymnasiums (investigations I, 1986–89; palpable measurement: 2165 lessons), Pańczyk [10].

HR(bpm)	Outdoors		Indoors (gymnasium)		t
Measurement	x	s	x	s	
HR1	95.44	2.37	95.07	3.89	0.20
HR2	124.12	2.77	118.43	4.49	2.54*
HR3	140.23	7.05	130.60	6.84	3.71**
HR4	123.55	3.09	116.23	6.10	2.81*
HR5	100.88	4.90	98.25	6.16	1.44

* significance at the level of 0.05; ** significance at the level of 0.01.

Table 2. Heart rate (T) in the same persons during lessons outdoors and indoors (investigations II, 1995–96; electronic HR measurements: 110 lessons) Pańczyk [10].

Minute of the lesson	HR				t
	Outdoor (n-55)		Indoors (gymnasium) (n-55)		
	x	s	x	s	
1	102.57	19.30	99.00	18.69	0.06
2	121.82	29.90	118.67	28.53	0.42
3	132.37	29.13	125.89	24.45	1.36
4	134.96	31.82	129.55	21.17	1.66
5	142.02	31.05	137.04	23.61	0.83
6	148.57	29.28	140.16	24.63	1.61
7	154.13	27.46	144.38	23.94	2.08*
8	153.15	26.51	144.04	30.83	1.56
9	158.65	25.63	146.28	23.67	2.73**
10	156.60	27.03	146.71	22.15	2.47**
11	154.87	32.57	143.31	20.43	2.45**
12	154.51	26.29	142.75	23.07	2.77**
13	156.05	28.10	146.18	25.23	2.03*
14	156.95	28.46	146.75	26.27	2.33*
15	157.07	26.82	147.13	23.64	2.36*
16	157.27	27.68	148.25	26.09	2.09*
17	162.58	23.78	148.00	25.75	3.13**
18	164.40	26.11	143.44	22.81	5.14**
19	162.56	26.75	145.25	26.34	3.70**
20	162.09	29.18	146.02	20.94	3.71***
21	164.20	23.95	141.40	26.15	5.36**
22	160.47	26.91	142.67	23.74	3.96**
23	159.89	29.10	144.07	26.21	3.66**
24	162.13	27.46	141.91	25.47	4.88**
25	166.27	28.66	146.55	25.38	3.82**
26	168.25	28.27	144.20	25.55	5.18**
27	171.27	26.96	143.27	27.36	6.00**
28	165.22	26.22	145.56	26.67	4.70**
29	173.29	26.80	143.67	30.57	6.00**
30	169.04	26.49	147.47	29.22	5.22**
31	168.53	28.96	146.75	28.05	4.88**
32	173.39	25.82	146.72	29.74	6.00**
33	170.44	26.72	150.64	27.14	4.90****
34	171.47	27.17	149.23	29.26	4.78**
35	167.74	27.65	147.56	26.90	4.99**
36	167.02	28.55	146.85	28.05	4.83**
37	168.02	29.06	151.96	25.04	3.78**
38	170.09	30.37	148.57	24.89	3.81**
39	172.31	24.79	147.05	28.64	3.63**
40	169.37	25.69	147.25	23.53	3.66**
41	166.42	27.59	142.32	23.79	4.43**
42	163.76	24.07	136.28	23.83	4.61**
43	162.90	25.19	139.19	22.37	3.24**
44	156.68	30.61	130.52	19.78	3.73***
45	153.93	35.06	125.19	14.98	3.21**
Average	159.09	27.58	142.46	24.99	

* significance at the level of 0.05; ** significance at the level of 0.01; *** significance at the level of 0.001.

Table 3. Fraction of time of physical education lesson (in%) for different intensities outdoors and indoors, Pańczyk [10].

Exercise intensity [HR]	Location	
	Outdoors (%)	Indoors (%)
≤140	26.4	47.4
141–159	23.2	26.7
≤160	50.4	25.9

Table 4. Fraction (in%) of maximal heart rate (HR_{max}) in students from IV–VIII classes reached during outdoor and indoor lessons (n=55), Pańczyk [10].

Age (years, class)	$\%HR_{max}$	
	Outdoors	Indoors
11, IV	74, 73	62, 4
12–13, V–VI	75, 3	68, 55
14–15, VII–VIII	80, 31	70, 35

Table 5. Exercise volume in students (measured by the number of steps) during outdoor and indoor lessons, Pańczyk [10] .

Statistical parameter	Location	RR	NN	RR+NN
		(Weighted average)		
x	Indoors	3716	6228	9944
	n	635	371	1006
	Outdoors	4426	7421	11848
	n	640	478	1118
s	Indoors	540	1080	2585
	Outdoors	554	1361	2943
t	Indoors-outdoors	4.25***	3.58***	4.01**

and educational curricula (in experimental and control classes, respectively). The groups were previously selected from all the schools in the voivodeship. Independent variable in both investigations was ca. 3/4 of the P.E. classes carried out outside the school facilities, in the field or schoolyard. Dependent variables included: (A) intensity and (B) the so-called physical activity volume (e.g. measurement of movement of limbs by pedometer), (C) physical fitness and (D) physical endurance, (E) absence from school, (F) climate, seasonal and land factors, (G) students mood before and during classes, (H) independent extraschool physical activity of the students.

Results of the Author's Investigations

A. Lesson intensity

A1. Palpable measurements of heart rate were taken by previously trained students. They measured heart rate five times during each lesson: HR_1 – during fall-in before the lesson, HR_2 – during warm-up, HR_3 – during peak of main part of the lesson, HR_4 – during transition to cool-down, HR_5 – just before the end of the lesson (Table 1).

A2. Second investigations involved electronic heart rate monitoring by means of Sport Testers (Table 2).

Adopting classification of training intensity according to Boileau [34] up to 140 bpm as low, 141–159 bpm as medium and 160 and more bpm as high, a considerable differentiation between the outdoor and indoor activities can be observed (see Table 3). Significantly higher intensity is typical of outdoor activities.

Using the formula of HR_{max}=220 – age (Karvonen), exercise intensity was calculated for each student. Then, based on the results of studies by Morrow and Freedson [35] which prove that exercise intensity over 75% HR_{max} is sufficient to improve cardiovascular endurance, the intensity thresholds were calculated as achieved by students in individual classes. The condition of stimulation of circulatory system is fulfilled by physical education lessons carried out outdoors (Table 4). The most intensive activity was observed by the students in fifth classes. As can be easily calculated from Table 4, average intensity of 15-year-old student amounted to 164 HR, while for 11-year old this value amounted to 157 HR.

B. Exercise volume

As a criterion for exercise volume during 45-minute physical education lesson, the authors adopted the number of the performed steps (total of movements). Measurements in both types of lessons were taken only for the first investigations, by means of pedometers worn on hands and legs. The better results were also observed for outdoor activities (Table 5).

Table 6. Results from Cooper test (metres) during the investigations I, Pańczyk [10] (measurement *I* in the beginning of class IV; *II* at the end of class IV; *III* at the end of class V; *IV* at the end of class VI).

Measurement	Girls					Boys				
	Outdoors		Indoors		t	Outdoors		Indoors		t
	x	s	x	s		x	s	x	s	
I n-407	1880	116	1947	109	2.03	2175	141	2132	156	0.85
II n-407	2017	169	1978	138	0.75	2288	144	2145	171	2.60*
III n-285	2099	174	1985	171	1.18	2335	105	2158	184	2.33
IV n-169	2190	118	2067	35	2.55	2571	76	2273	214	1.88
Differences										
II–I	137		31			113		13		
III–I	219		38			160		26		
IV–I	310		120			396		141		

Table 7. Results from Cooper test (meters) during the investigations II (Pańczyk [10].

Measurement	Boys and girls (n = 227)				
	Outdoors		Indoors		t
	x	s	x	s	
I	1952	147	1999	121	1.16
II	2216	201	2028	139	3.30*
Difference	264		29		

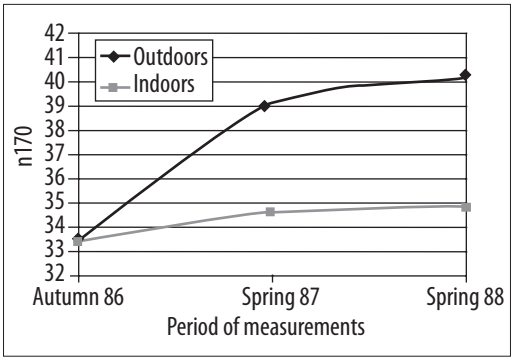

Figure 1. Changes in exercise capacity (n170) in students during first two years of the experiment (investigations I, Pańczyk [10]).

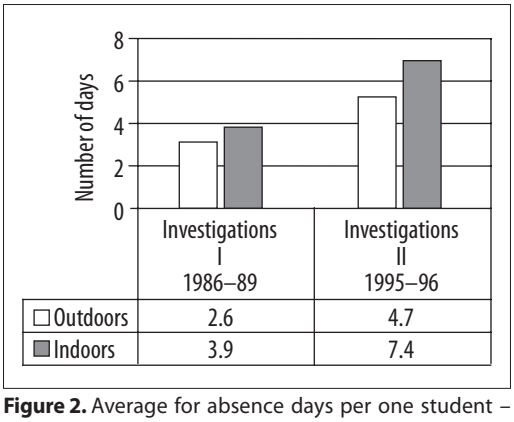

Figure 2. Average for absence days per one student – dynamics of changes during 1986–96, Pańczyk [10].

C. Physical fitness

Physical fitness was measured by means of Cooper test (12 min). The results of both investigations (Tables 6,7) prove higher efficiency of outdoor activities.

D. Physical endurance

Physical endurance in students measured by means of Hettinger's and Rodahl's test modified by Krysińska [36] clearly proves higher efficiency of the lessons carried out outdoors (Figure 1). Very similar coefficient n_{170} during initial measurement differs statistically after a year ($p<0.001$) and after two years ($p<0.01$) of the first experiment.

School absence

School absence, due to health-related reasons does not differentiate between the students from the groups of outdoor and indoor activities, neither during first nor during second experiment. However, average number of sick leaves per one student was lower in outdoor groups (Figure 2).

F. Climate and season-related stimuli

Climate and season-related conditions for the physical education lessons carried out during both experiments (Table 8) were similar. Therefore there are the basis for the conclusion that these factors, as stimuli

Table 8. Distribution of the most significant climate factors (average annual) which affected students who took part in outdoor physical education lessons in 1986-1996, Pańczyk [10].

Climate factor	Average number of lessons a year	
	Investigations I	Investigations II
Humidity, fog, rain	10	11
Temperature below 0°C	9	10
Sun	23	25
Wind	17	21
Snow	6	9

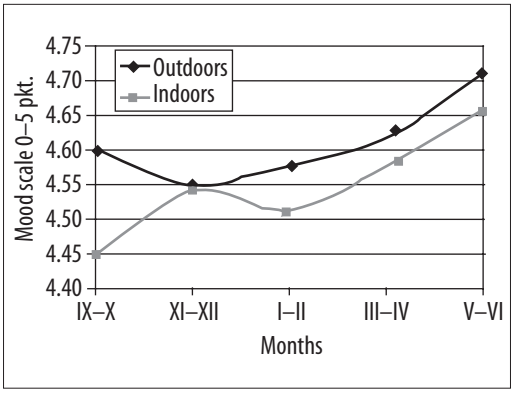

Figure 3. Differentiation of mood in relation to the season and location of physical education in students from classes IV–VI (investigations I, Pańczyk [10]).

for the natural environment, had similar effect on student's health, independently of the period when the activities were carried out.

G. Mood

Even autumn and winter colds did not deteriorate mood among the students in relation to those who exercised indoors (Figure 3). The students made subjective assessment of their mood before and after lessons on a scale of 1–5 (1 – very poor mood, 5 – perfect mood).

H. Voluntary extraschool physical activity

Three-year observations proved that students who participated in outdoor classes were more often involved in voluntary extraschool physical activity (Figure 4). This empirical proof is very important from the standpoint of formation of health-related lifetime attitudes.

The compared empirical data (A–H) provide solid confirmation that outdoor physical education generates a number of efficient stimuli cumulated both in somatic and mental area of students.

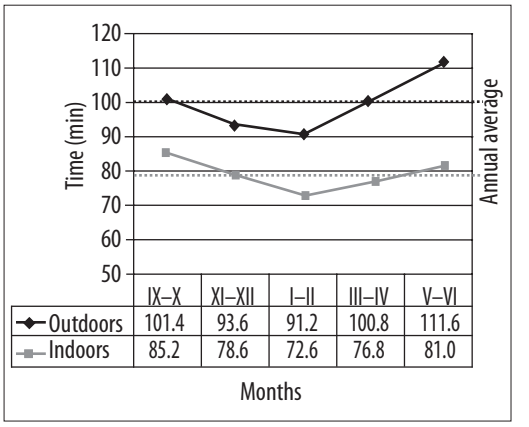

Figure 4. Week-long extraschool physical activity (in minutes) with consideration of seasonal changes in 1986–89 (investigations I, Pańczyk [10]).

Selected results of the investigations by other authors

The most complex and comprehensive investigations of the effects of physical education in 1991–94 were carried out in the United States [6]. Starting point for these investigations was results of scientific research by Paffenbarger, Caspersen, Kelder and others. The most important conclusions from these studies include:

- lack of physical activity considerably increases the risk of heart diseases [4,37].
- the more physical activity in childhood, the more activity in adulthood [5].
- US schools are the place which should compulsory organize high-intensity physical activities for children [38].

The investigations were organized by the National Heart, Lung and Blood Institute by means of four Child and Adolescent Trial for Cardiovascular Health in: California, Louisiana, Minnesota and Texas as an element of evaluation of the National Health Program (Health 2000). Questions concerned the levels of physical activity among children in different aspects and differences in these levels. Differences in physical activity and energy cost during lessons in gymnasiums (171 lessons) and outdoors (121 lessons) were also studied. In total, close coded observation covered 293 thirty-minute lessons in 95 schools, recording type of movement (lying, sitting, standing, walking, high-intensity activities) and type of activities every 20 seconds. The results for outdoor classes turned out to be more beneficial from the standpoint of health-related needs, despite the fact that lessons themselves were slightly shorter. During lessons in gymnasiums, children sat or lied for 30.7% of lesson time (8.5% for outdoor activities); they stood for 37.6% and 49.3% for indoors and outdoors, respectively; walking and running amounted to 31.7% for gymnasiums and 42.2% for outdoors. Energy costs, calculated based on the assumption

Table 9. Some negative results of departure from outdoors as a place of exercise during physical education lessons (Pańczyk [39]).

Selected factors		Investigations I 1986–87 [%]	Investigations II 2006–07 [%]
Students who do not need physical education		3.9	10.8
Which physical education is healthier?	Indoors	6.6	30.8
	Outdoors	41.2	15.0
	Neither	1.8	9.3
Students afraid of outdoors physical education		4.3	14.6
Reasons for being afraid	Cold	1.0	70.8
	Rain	0.6	7.2
	Dirty surface	0.9	10.3
	Sweating and fatigue	4.0	4.5
	Risk of injury	0.3	7.2

that energy cost of lying is 0.029 while for high-intensity activities this value is 0.144 kcal/kg/min, was higher for outdoor activities: 0.079 kcal/kg/min, whereas in gymnasium this cost amounted to: 0.071 kcal/kg/min. Therefore outdoor activities, mainly due to higher space proved to be more beneficial in the aspect of assumptions by the National Health Program.

Location of the physical education classes – changes throughout 20 years

The results of the author's own studies and the investigations by other authors from different countries made authors ask an elementary question: As far as care for student's health is concerned, is outdoors a preferred optimal location for physical education classes?

The author of this study supported his empirical argumentation on his own investigations carried out twice in the south and east of Poland. The same methodology and research techniques were employed throughout twenty years, which allows for observation of the dynamics of changes in this phenomenon for two generations of students. Investigations I were carried out in the school year 1986/1987 and covered students from elementary and high schools. Investigations II, carried out in the school year 2006/2007, encompassed students from elementary schools, junior high schools and high schools (period after the reforms in Polish education system). The investigations were carried out in randomly chosen schools of Chełm, Lublin, Zamość, Przemyśl, Rzeszów and Tarnobrzeg Voivodeships during first investigations and randomly chosen schools of the same regions in Lublin and Subcarpathian Voivodeships (after the Poland Local Government Reorganization Act) during second investigations. These regions of Poland are characterized by relatively low level of urbanization and similar, relatively poor infrastructure for different forms of physical activity which require special installations, devices, apparatuses etc. These regions, however, are rich in tourism and recreational values and unpolluted natural environment. Unpolluted, thus health natural environment should encourage outdoor physical activity, independently of the season of the year.

A single opinion poll was employed by means of a questionnaire "My opinion on physical education indoors and outdoors". The questionnaire, except for personal information, included closed-ended questions concerning: health status, body built, personal physical activity, participation and attitudes towards physical education and its health-related values. Nearly 1300 filled-in questionnaires were collected in each investigation (on randomly chosen samples of the students). The analysis covered 1218 (investigations I) and 1099 (investigations II) of them [39].

Students from the south and the east of Poland in the school year 1986/87 (investigations I) declared that 51.7% of physical education lessons are carried out indoors whereas 48.3% of them are taught outdoors. Twenty years later, students of the same region (investigations II) attended 84.3% of the classes indoors and 15.7% outdoors [39]. Thus the tendency of more and more frequent departure from outdoor facilities as a place for physical education can be observed. As recently as at the end of the previous century, nearly 40–50% of the

students participated in outdoor activities whereas this number is currently limited to 10–15%. Physical education is almost exclusively associated with gymnasium. Avoiding outdoor activities brings a number of negative effects of mental nature (Table 9). From the standpoint of health promotion, identified with activity throughout life, maintaining of this model is disadvantageous.

Conclusions

Health-related effects of physical education depend considerably on the location of the classes. This was noted by western experts and, despite a number of the obstacles which are magnified by consumerist lifestyles and widespread reluctance to take up physical activity, they promote outdoor physical activity in different schools and among adult societies. The school of the 21st century should take these trends into consideration in order to achieve the health-related goals. Otherwise physical education will essentially remain a fake education. Health needs of the students are extensive and invariably topical. Modern physical education and individual physical activity (sport for all) are able to rise to this challenge. One of the most fundamental measures for this modernity is ability to make use of the resources of the natural environment through regular physical exercise.

In the philosophical meaning the issue is into certain meaning parallel to the issue of the possibility of publishing valuable findings of own studies (which is useful for specific aspects of health, social, economic etc.) in the most prestigious scientific journals by authors regardless of the region where the publication is created [40]. It is an essential condition of the sustainable scientific development – individuals, institutions, country. However there is a fundamental difference between scientific publication and exercises in the open air. Exercises will be effective if the natural environment of the man meets health standards.

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