

APPLICABILITY AND QUALITY ASSESSMENT OF THE SET OF EQUIPMENT IN THE PROJECT “POLYGON FOR PHYSICAL ACTIVITY OF SCHOOL-AGED CHILDREN“ IN PRIMARY SCHOOLS WITHOUT GYMNASIA

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Abstract:

In 2015, 120 main primary schools in Croatia did not have a school gymnasium, and could not carry through the full-time compulsory Physical Education (PE) classes. To ensure regular physical exercise to all children and help teachers, the Croatian Institute of Public Health has implemented the project “*Polygon for Physical Activity of School-Aged Children*”. This paper aims to present the usability and functionality assessment of the multipurpose kinesiology equipment set used in the Project in the primary schools without gymnasia based on the teachers’ experience and appraisals in three independent assessment waves. Results show that after receiving the set the teachers perceived they had better conditions for teaching PE class and managed to fulfil PE curriculum goals and tasks. Students’ motivation for physical education class also improved in some areas, as well as teachers’ satisfaction with the conditions for and school investments in PE class. Most of the teachers perceived that the multipurpose kinesiology equipment set had the potential to improve the quality of PE class and to be used in other classes as well. According to the obtained data it could be assumed that this multipurpose kinesiology equipment set is a positive innovation in the teaching process and presents a strong potential for alleviating the spatial and material problems teachers in schools without gymnasia are experiencing in their work.

Key words: *physical education and training, public health, schools, exercise promotion, students, teacher satisfaction*

Introduction

Numerous studies have scientifically proven the role of physical activity (PA) as one of the vital health determinants from birth to adolescence (Ferraro, Gaudet, & Adamo, 2012; Gísladóttir, Haga, & Sigmundsson, 2013; Kodama, et al., 2009; Morton, Atkin, Corder, Suhreke, & van Sluijs, 2016). Despite this, children today are less physically active on the account of a sedentary way of life. Consequently, the incidence of overweight and obesity is increasing and negatively affects lifelong health (de Greeff, Bosker, Oosterlaan, Visscher, & Hartman, 2018; Morton, et al., 2016). Positive childhood experiences have a strong impact on forming healthy life habits and preserving health (Goldfield, Harvey, Grattan, & Adamo, 2012; Jureša & Petrović, 2012; WHO, 2004).

Because school-aged children spend almost half of their awake time at school, schools are an important environment for PA promotion and reduction of sedentary behaviours (Langford, Bonell, Jones, & Campbell, 2015; Langford, et al., 2015). The Physical Education (PE) class is significant for students’ health since it necessitates their active participation. PE differs considerably from other classes specifically in terms of material, technical and weather conditions of teaching. The importance of PE, in the sphere of the education system, is that students are being taught how to move properly and to use the acquired motor skills to overcome obstacles in space. Besides the individual characteristics of a teacher, issues such as lack or non-availability of a gymnasium, inadequate and incomplete facilities and equipment play a significant role in fulfilling a

curriculum and accomplishing the PE goals (Kul, Yilmaz, & Yasartürk, 2018; Tsangaridou, 2017).

Lacking material conditions, i.e. the lack of a gymnasium and quality exercise equipment, is considered to be the foremost issue that influences the work of PE teachers (Kul, et al., 2018; Pažur, 2019). According to the Pedagogical Standard of Primary Education in the Republic of Croatia (MSES, 2008b), PE classes can be held both outdoors, weather conditions permitting, i.e. on the playground, athletic tracks and fields, pitches, free green areas, in outdoor swimming pools, etc., and indoors, in gymnasias, fitness and aerobic centres, swimming pools, etc. Additionally, various devices, visual, auditory, audio-visual, and textual assets and technical aids and equipment can be used while teaching PE. However, the actual situation with PE teaching in primary and secondary schools in the Republic of Croatia is somewhat different from the standard. A large number of schools, both main and peripheral, have no gymnasium or outdoor facilities. To help overcome the spatial and material obstacles brought by the lack of gymnasias and to ensure equal opportunities to all students to regularly attend PE and help teachers teach PE to students in grades one through four in Croatia, the Croatian Institute of Public Health (CIPH) has designed a project called “*Polygon for Physical Activity of School-Aged Children*” (Polygon).

Description of the Polygon Project

In the school year 2014/2015, there were 2055 primary schools in the Republic of Croatia, 860 main and 1,195 peripheral schools (Croatian Bureau of Statistics, 2016). Of the 860 main primary schools, 120 of them had no or limited access to a gymnasium. Consequently, these schools could not carry out the full-time compulsory PE of 45 minutes three times per week for grades one to three and 45 minutes two times per week for grades four to eight (MSES, 2006). The Polygon project was implemented to ensure the fundamental logistics for teaching mandatory PE in main primary schools without gymnasias and, thereby, reinforce the habit of regular PA in students as one of the key factors in childhood obesity and overweight prevention. Namely, childhood obesity and overweight is a significant risk factor for developing any of the leading non-communicable diseases, responsible for about 90% of all deaths in Croatia (Stevanović, Capak, & Benjak, 2016).

The basic tool used in the Polygon project that helps class teachers achieve educational goals and tasks is a carefully designed multipurpose set of kinesiological, physical exercise aids (Set), consisting of 25 easily assembled and disassembled elements, adaptable to various indoor or outdoor locations. The elements of the Set were more thoroughly described elsewhere (CIPH, 2016).

As part of the Polygon project, the CIPH has, with the help of the Ministry of Health, secured the funds for the procurement of 120 Sets to be donated to all main primary schools without gymnasias in the Republic of Croatia. Additional assistance was offered in the form of a Manual (Krtalić, Pejnović Franelić, & Delaš, 2015) tailored to the practical needs of class teachers and kinesiologists to help them find creative solutions to existing implementation restrictions and to help them achieve the objectives of PE. The Manual is, likewise, intended as secondary literature for teaching associates, students and all others who work in any form of physical education. Furthermore, the education of three-member school teams participating in the Polygon project was organized in collaboration with the Ministry of Science, Education and Sport, and the Education and Teacher Training Agency. After the education and the distribution of Sets, the schools were contacted to see if they required any additional training in the use of the Set. None of the schools sought any further assistance. Since the Set was used for the first time within the Project with the aim of enabling regular PA and full time compulsory PE in schools without gymnasias, before evaluating the whole Project, it was important to assess its usability and functionality as well as some aspects of teachers' experience related to the usage of the multipurpose kinesiology equipment set in primary schools without gymnasias.

Objective

The objective of this paper is to present an assessment of the usability and functionality of the Set in primary schools without gymnasias based on some aspects of teachers' experience in using the Set. The evaluation included an assessment and comparison of the following dimensions of the Set:

- Possibilities for PE implementation in schools without gymnasias before and after the introduction of the Set,
- Attributes of PE implementation in schools without gymnasias before and after receiving the Set (teachers' interest in and satisfaction with conditions for teaching PE, students' motivation for PE, and suitability of the exercise, kinesiology equipment for the youngest students),
- Functionality and applicability of the Set within PE and other classes.

Methods

The teachers' perceptions and experiences in relation to the Set objectives were assessed by inviting the teachers who were using the Set in 120 schools without gymnasias to participate in an online survey. Each of 120 participating schools had a three-member team comprised of two class teachers and one PE teacher, a kinesiologist, making

a total target sample of 360 teachers, i.e. 240 class and 120 PE teachers. These teachers were the ones who used the Set primarily in PE but also within other school activities.

Data were collected with three online questionnaires specifically designed for the purpose of this evaluation, and each administered at a different time point:

1. *Questionnaire 1* (Q1) assessed the conditions for teaching PE and experiences in teaching PE before the introduction of the Set,
2. *Questionnaire 2* (Q2) assessed the conditions for teaching PE and experiences in teaching PE after the introduction of the Set, and
3. *Questionnaire 3* (Q3) assessed the functionality and applicability of the Set.

The questionnaires were anonymous with no possibility to reveal the identity or the function of respondents. The questionnaires consisted of different types of questions: Likert scale type questions, yes-or-no questions, multiple-choice answers, or open-ended questions. All targeted teachers received the invitation and the online questionnaires via an e-mail link with accompanying instructions. The participation was voluntary, according to ethical principles. Q1 was administered at the beginning of the second semester, and Q2 and Q3 at the end of the second semester of the school year 2015/2016. Due to the complete anonymity of the online survey, the responses given at different time points could not be paired. The characteristics of the respondents on all three questionnaires are presented in Table 1.

In all three subsamples, the respondents were mostly female teachers. The majority of them was between 40 and 49 years of age and had between 16 and 25 years of working experience.

The possibility of PE implementation in schools without gymnasias after the introduction of the Set was assessed by comparing teachers' experiences and perceptions of the conditions and possibilities to teach PE in comparison to other schools in the community before (Q1) and after receiving the Set (Q2). Additionally, the degree to which it was possible to teach full-time compulsory PE in indoor school areas before and after receiving the Set was also assessed by comparing responses on Q1 and Q2.

Different attributes of the PE implementation experience in schools without gymnasias after receiving the Set were assessed with the following: teachers' self-assessment of their level of interest in teaching PE and satisfaction with conditions for teaching PE, assessment of students' motivation for PE and the suitability of school exercise equipment for the youngest students before and after receiving the Set, gained through Q1 and Q2.

The functionality and applicability of the Set within PE and other classes were assessed with Q3 through teachers' assessment of the Set's suitability for improving conditions to teach PE as well as other classes, reaching PE curriculum objectives and tasks, and through teacher's assessment of the students' responses to using the Set.

Statistical analysis

Collected data were processed using methods of descriptive statistics. Relative data frequencies were analysed for categorical variables. Data samples were treated as two independent data samples – a sample before receiving the Set and the sample after receiving the Set, rather than dependent samples of participants, because the responses could not be matched. The difference between the observed

Table 1. Characteristics of respondents to Questionnaire 1, Questionnaire 2, and Questionnaire 3

Variable	Questionnaire 1 (N=190)	Questionnaire 2 (N=138)	Questionnaire 3 (N=111)
	% (N)	% (N)	% (N)
Sex			
Female	67.9 (129)	82.6 (114)	93.7 (104)
Male	11.1 (21)	6.6 (9)	6.3 (7)
Age (years)			
23-29	9.5 (18)	5.8 (8)	7.2 (8)
30-39	24.2 (46)	28.3 (39)	31.5 (35)
40-49	31.1 (59)	38.4 (53)	42.3 (47)
50-59	12.6 (24)	16.7 (23)	18.9 (21)
>60	1.6 (3)	0.0 (0)	0.0 (0)
Work experience (years)			
≤5	12.2 (23)	12.2 (17)	15.3 (17)
6-15	24.3 (46)	25.9 (36)	27 (30)
16-25	28.5 (54)	37.6 (52)	41.4 (46)
≥26	13.8 (26)	12.8 (18)	15.3 (17)

means from the sample before receiving the Set and the sample after receiving the Set was compared using *t*-test. Results were analysed at 0.05 level of significance. The data was statistically processed using the IBM SPSS Statistics software, ver. 23.0, 2015. (ID: 729038) (IBM Corp, 2015).

Results

The results presented in Table 2 show that most teachers, 74.11% of them, moved the Set between classrooms, or occasionally assembled it in various school areas, while the remaining teachers had the Set permanently placed in a specific place. The use of the Set was largely in line with the teacher's beliefs on the optimal location of the Set in their school given the available spatial and technical conditions. Results show that 55.86% of teachers believed the optimal use of the Set in their school was to assemble it, as needed, in various school areas (the lobby, exercise area, schoolyard, etc.) or relocate it between classrooms, while 38.74% thought the best option was to have it assembled in a permanent place. Data on the frequency of the Set use in PE, show that 85.59% of teachers regularly used the Set, once to three times per week; 28% of teachers encountered difficulties in the application of the Set, most commonly in assembly and disassembly.

As presented in Figure 1, over two thirds of the questioned teachers, 67.66% of them, perceived having poorer conditions for teaching PE in comparison to other schools in the community before receiving the Set, as did only 28.57% of the

questioned teachers after obtaining the Set. Data in Figure 2 shows that most teachers, 73.81% of them questioned after receiving the Set, found that they could fulfil between two thirds and the whole compulsory PE curriculum indoors, while before receiving the Set, 80.72% of the questioned teachers thought that they could fulfil two thirds or less of compulsory PE curriculum indoors.

Results presented in Table 3 show a statistically significant difference between before and after receiving the Set in the attributes of PE implementation in schools without gymnasias. Overall, results show that students were generally motivated for PE. When comparing results before and after the introduction of the Set, we found a significant difference in teachers' responses on statements related to students' reactions to PE implementation; "My students love PE", "Students are motivated to exercise with school equipment" and "My students prefer having PE outdoors" but not on the "My students are generally motivated for PE". Also, a significant difference was found between the opinions of teachers questioned before and after receiving the Set on the adjustment of school equipment to the youngest students. Finally, regarding teachers' satisfaction, we found that the group questioned after receiving the Set was more satisfied with the conditions for teaching PE and with school investments in PE, but not more interested in applying new teaching methods in comparison to the group questioned before receiving the Set.

The data on functionality and applicability of the Set within PE and other classes, presented in

Table 2. Actual and optimal school areas where the Set is located

	Permanently placed in a classroom (N)	Permanently placed in a specific place (N)	Permanently placed in an exercise area (N)	Relocated between classrooms (N)	Used in various school areas (N)	Other (N)	Total
Actual	5	14	10	27	56	10	111
Optimal	8	17	18	17	45	6	111

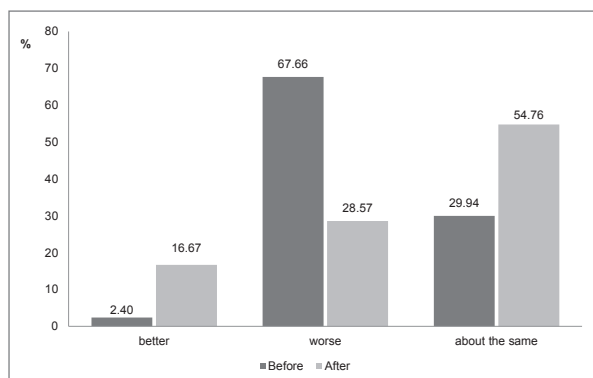


Figure 1. Teachers' assessment of conditions and possibility of teaching Physical Education class in schools without gymnasias before and after receiving the Set.

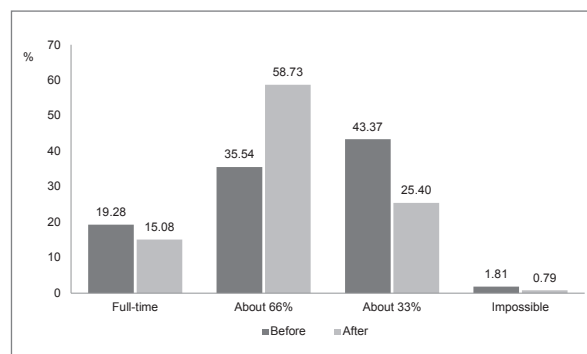


Figure 2. Teachers' assessment of the degree to which it was possible to teach full-time compulsory Physical Education class in indoor school areas in schools without gymnasias before and after receiving the Set from the Polygon project.

Table 3. Assessment of different attributes of the PE implementation in schools without gymnasia before and after receiving the Set

	Before			After			t	DF	p
	N	M	(SD)	N	M	(SD)			
My students love PE.	165	4.73	(.69)	126	4.90	(0.33)	2.534	289	.0118*
Students are motivated to exercise with the school equipment.	166	3.65	(1.03)	126	4.49	(0.68)	7.942	290	<.0001***
My students prefer having PE outdoors.	167	4.10	(.99)	126	4.36	(.85)	2.373	291	.0183*
My students are generally motivated for physical activity.	166	4.55	(.70)	126	4.65	(.51)	1.387	290	.1667
Sports equipment in my school is adapted to even the youngest students.	166	2.81	(1.09)	126	3.90	(1.05)	8.621	290	<.0001***
I am content with the conditions for teaching PE.	166	2.47	(1.08)	126	2.98	(1.28)	3.979	290	.0001***
I am not satisfied with the school investments in the PE.	165	3.90	1.04	126	3.61	1.08	-2.285	289	.0230*
I am interested in applying new teaching methods.	166	4.54	(.71)	126	4.60	.55	.693	290	.4890

Note. PE – Physical Education class, N – number of participants, M – arithmetic mean, SD – standard deviation, t – t-statistics, DF – degrees of freedom, p – probability, * – significant at ≤ 0.05 level, ** – significant at ≤ 0.01 level, *** – significant at ≤ 0.001 level.

Table 4. Perception of functionality and applicability of the Set

	Not at all (%)	Partly (%)	Fairly (%)	Highly (%)	Fully (%)
My students liked the Set.	.00	.90	4.50	11.71	82.88
The Set improves possibilities to teach PE.	.00	.00	9.91	47.75	42.34
The Set improves capacity to reach PE curriculum objectives and tasks.	.00	.00	18.92	58.56	22.52
The Set is suitable for teaching other classes.	.90	5.41	37.84	42.34	13.51

Note. PE – Physical Education class.

Table 4, show that the majority of teachers, 90.09% of them, saw the Set's potential to highly or fully likely help improve the quality of PE. Most of them, 81.08%, also responded that the Set is highly or fully likely to help meet all PE objectives and tasks set by the National PE Curriculum. Additionally, 94.59% of teachers agreed that the students liked the Set and 99.10% responders recognized the Set's applicability to other classes.

Discussion and conclusion

The aim of this paper was to present an assessment of the usability and functionality of the Set in primary schools without gymnasia. The results showed that most teachers, 86% of them, used the Set regularly, once to three times per week and were well acquainted with it. Due to the teachers' experience with using the Set, their perspective on its applicability is relevant for further implementation and strengthening of the Polygon project.

Overall, regarding the possibility of implementation of PE in schools without gymnasia, the Set

brought a positive change to school conditions and possibilities for teaching PE in the indoor school areas. The dramatic change in modern life and its many demands brought up recommendations for PA for health, which for children aged 6-18 years equal a minimum of 60 minutes of moderate to vigorous physical activity per day (WHO, 2010). Despite this recommendation, the Republic of Croatia, in the National Curriculum for Primary Schools, mandates three school-hours of PE per week in the first three grades and only two school-hours in the fourth grade of primary school. Also, according to the Pedagogical Standard of Primary Education in the Republic of Croatia (MSES, 2008b), gymnasia are required for teaching PE to primary school students in grades five through eight (MSES, 2008a). Due to restricted resources and a lack of investments and funding, many schools have poor spatial, material, and technical conditions, and do not have school gymnasia. Due to that, there is a risk that children would not be able to reach either full-time PE curriculum, or PA recommendations for health. Supplying schools with resources in

form of the Set, additional equipment required for teaching PE, through the Polygon project, proved to be beneficial for the administration of PE in over two thirds of main schools lacking gymnasias. The results obtained by comparing teachers' assessment regarding the conditions before and after introducing the Set suggest that the Set has contributed to improving the quality of PE and providing the capacity for teaching PE in schools without gymnasias. Given that the possibility to administer PE in schools without gymnasias gives students additional time spent in moderate to vigorous PA and not sedentary activities, it can be argued that the purpose of the Set might also be related to health outcomes and goes above and beyond its function to assist in the implementation of PE (S. Chen, Kim, & Gao, 2014), which should be further explored in the future.

Another observed change after introducing the Set was related to different attributes of PE in schools without gymnasias. First of all, a significant change was observed in regard to teachers' perception of students' motivation for PE. When assessing motivational or other PE attributes after receiving the Set, teachers reported, on average, that students loved PE, were motivated to exercise with the school equipment and preferred having PE outdoors more in comparison to before receiving the Set. According to the "Copenhagen Consensus Conference 2016: children, youth, and physical activity in schools and during leisure time", Theme 3: Physical activity in children and youth: engagement, motivation, psychological well-being, "an autonomy supportive, mastery focused and caring/socially supportive environment, positively influences children's and youths' self-determined motivation, physical activity behaviour and holistic well-being" (Bangsbo, et al., 2016). Students' enjoyment in PE is related to meaningful choice, i.e. the choice that is aligned with and reflects student's goals, interests and values (Assor, Kaplan, & Roth, 2002). It may be argued that introducing a new set of equipment that is interesting to students, offers a variety of materials and activities to choose from, and at the same time makes them and their teachers feel competent is the reason for the observed increase in students' affinity to PE after the introduction of the Set (Domville, Watson, Richardson, & Graves, 2019; Xiang, McBride, & Gao, 2011). Also, Chen and associates found that students' enjoyment and interest in PE were related to novelty, challenge, exploration intention, and attention demand dimensions, all features brought by the new Set (A. Chen & Darst, 2001; A. Chen & Wang, 2017).

An additional change brought by the Set was related to conditions for PE in terms of equipment and school investments in PE. After receiving the Set, teachers were more satisfied with school conditions and investments in PE. The possibilities for

creative solutions in the administration of PE and developing motor skills in children in schools are abundant but depend on the spatial conditions of the school. Not having either equipment or school investments presents an obstacle that teachers from schools without gymnasias face on a daily basis. Resource adequacy influences job satisfaction, hence a lack of facilities and equipment might consequently make teachers less content with their job (Aldridge & Fraser, 2016). Receiving the equipment for PE contained in the Set improves conditions for administering PE, thus making the teachers more satisfied and less burned-out (Kroupis, Kouli, & Kourtessis, 2019). Furthermore, after receiving the Set, teachers perceived that their school equipment was adapted to the youngest students. This notion is especially important from the developmental perspective. Children, at the age of entering the school are at the stage when they are developing basic movement skills. These skills form the foundation of almost all later sporting and physical activities and children with strong movement skills are more likely to be active adults (Bailey, 2006). Strong fundamental movement skills also contribute to the overall development including healthy weight, cognitive and academic skills (Barnett, et al., 2016). Going to school in an environment that is, due to a lack of gymnasias, restricted in terms of physical activity, may pose a great threat to the development of basic movement skills. Therefore, the Set, being perceived as suitable for the youngest students, can help to create opportunities for the youngest children to be more active and develop strong basic movement skills that will contribute to their overall development.

After receiving the Set, data on the teachers' interest in applying new teaching methods in PE did not differ significantly. One may argue that the reason for this was that the teachers did not perceive the Set as a novel teaching method and felt comfortable using it.

Key factors for the Set applicability that may affect the enthusiasm and satisfaction of teachers are other spatial and technical school conditions in schools without gymnasias, as well as the choice of location of the Set (McCaughy, et al, 2006).

From the standpoint of functionality, besides its overall contribution to the administration of PE and students' interest, teachers found that the Set was also suitable for teaching other classes. Using the Set to integrate PA into the classroom will result in less time spent sedentary and add to the time spent in PA (Beighle, Erwin, Webster, & Webster, 2019). Besides that, using PA in the classroom will also enable students to think more broadly about the lesson being learned as well as experience alternative pathways for learning, i.e. motor and sensory, which is the optimal way of learning emphasized by leading educational scholars such as Howard

Gardner or Maria Montessori (Gardner, 2006; Montessori, 1995).

Regarding the placement of the Set, more than half of teachers agreed that the optimal use of the Set was to either assemble it in different school locations or to move it from classroom to classroom. When placing the Set this way, not only can PE be more easily administered in limited spatial conditions, but also, the Set can be used for other purposes as well. Having the Set located in an approachable location for students to use it during recess might increase students' active time during recess and contribute to overall daily time spent in PA (Delidou, Matsouka, & Nikolaidis, 2015).

The present study is the first study in Croatia to identify enhanced opportunities for PE time in indoor school areas, thus ensuring teacher's uninterrupted work, regardless of the weather, and ascertaining the functionality and applicability of the Set. These results will serve as the first step towards a broader evaluation of the entire Polygon project that will illustrate its public health impact.

The obtained results, however, should be perceived in line with several limitations to this study. The first one is related to the sample. Although all three subsamples consisted of teachers from the same schools, we could not match the participants, so the samples were treated as independent measurement samples. Second, a similar questionnaire ought to be administered after a longer period of using the equipment in order to gather more information on the sustainability and applicability of the equipment and more detailed information of the use of the set in different circumstances, i.e. in different parts of PE, during teaching other classes, during extracurricular activities, and during recess. In future research, including students' experiences and perception of the Set would additionally contribute to the evaluation of this toolkit, designed to enable students' PA in schools with limited resources, as well as including longitudinal data such as in a form

of diary to track the implementation of Set more precisely. Also, objective measures should also be incorporated into the evaluation to detect improvement in objectively measured movement skills with and without the Set.

Conclusively, the results of this study have shown that using the Set from the Polygon project is likely to help minimize or solve the problem of implementing all compulsory PE in primary schools without gymnasia. School team members have acknowledged the opportunity and advantages of the new tool and expressed their satisfaction with it. Teaching and motivating students to exercise in school is a challenge, as well as a task, for every teacher (Mawer, 2014). Reinforcing the habit of daily PA and helping students to internalize it is one of the pivotal prerequisites to preserving children's health and preventing unhealthy life styles (S. Chen, et al., 2014; Lonsdale, et al., 2013). Teachers, as leaders of PE classes, have a great opportunity to positively affect a multitude of personal traits, capacities and qualities of their students (Bailey, 2006). In an organized attempt to overcome the consistently overwhelming challenges of encouraging children to be more active and less sedentary, this project is a novel opportunity for teaching and a concrete opportunity for mitigating the existing spatial and material challenges many schools are facing. Comparative advantages of this particular Set give schools without gymnasia an opportunity to improve the quality of their PE and to motivate students to be more active and contribute to their lifelong health. Specifically, the financial advantage of the Set should not be disregarded: investing into the Set in question is a way more cost-effective in comparison to building a new gymnasium. In other words, poor finances and the inability to build enough gymnasia impedes the implementation of full-time compulsory PE. This can partly be solved by using the Set to ensure children's regular PA inside and outside school grounds.

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