American University of Armenia
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EVALUATION OF MINI- TENNIS PROGRAM FOR YEREVAN FIRST GRADE SCHOOLCHILDREN 6-7 YEARS OF AGE

(Professional Publication)

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Abstract

Physical inactivity has become a serious health problem throughout the world. Three out of five Canadian children and youth aged 5-17 years are not active enough for optimal growth and development. Physical inactivity has been identified also as one of the major risk factors for many chronic health conditions.

In the Republic of Armenia, physical inactivity is also a public health problem. There is lack of public playgrounds, physical education teachers, and sport gyms or equipment in secondary schools. However, there are no known epidemiological studies, previously conducted on this problem in Armenia. The Mini-Tennis program, implemented in six secondary schools during the physical education classes, filled this gap to some extent.

The current study is aimed to evaluate the program, which was implemented from September to May, 2001. Classes of the program were conducted during physical education sessions once per week, lasting 45 minutes as part of the students' curriculum. Six secondary schools were selected by convenience sampling methods for the "Mini-Tennis" program. A total of 369 children were involved in the study. The tests utilized in the program were the following: running, jumping, throwing and catching.

Using the secondary data, the improvement in performance of 6-7 years old first grade Yerevan schoolchildren after the implementation of the Mini-Tennis program and the difference between the physical activity scores of 6-7 years old first grade Yerevan schoolchildren taught by physical education teachers versus classroom teachers were examined. Statistically significant improvement in children's scores was observed in all 4 tests. The mean difference in scores in classes with physical education teachers versus classroom teachers was observed in throwing, running and catching was also statistically significant.

Due to the established effectiveness of the program and its feasibility it is recommended to broadly implement the Mini- Tennis program in Armenia either in schools during physical education classes as part of the student's curriculum or additional physical activity promotion program.

“ Exercise is the body’s fountain of youth”

Introduction

Physical inactivity has become a serious health problem throughout the world. Each year, physical inactivity contributes to nearly 260,000 deaths in the US (1). Three out of five Canadian children and youth aged 5-17 years are not active enough for optimal growth and development (2). “While the time spent being active appears adequate as a basis for supporting a habit of lifelong activity, only two-fifths of children participate in activities of sufficient intensity to meet the guideline for optimal growth and development set in the Lifetime Physical Activity Model” (3). Unhealthy behaviors take many years to present themselves clinically, but there is a compelling reason to believe that helping children learn to be active early in their lives will provide an important foundation for lifetime physical activity. Recent studies have clearly shown that early signs of chronic disease and risk factors for chronic disease such as elevated cholesterol level and hypertension, which would be considered normal in middle- aged population, can be found in children (9).

Several studies have documented that the presence of chronic disease risk factors in children are associated with low levels of physical activity (10). The domains that influence this problem are the following: first, there is a lack of parental support: “4-7 years children are much more likely due to be active if their parents are active. This could possibly be due to a genetic predisposition to activity, but it is more likely due to parents being role models and having the children share in family activity” (4). Family involvement appears to be a key to children's physical activity patterns (5). The second reason is due to poor self-efficacy for physical exercise and also poor knowledge about the importance and value of physical

exercise. The third reason for inactivity is a lack of space. The last reason could be the cost of sports equipment.

Guidelines, which were included in *Healthy Children 2000*, note that in addition to being physically active, “children should strive for at least 60 minutes daily of moderate intensity physical activity” (11). Greater benefit can be obtained from more vigorous exercise at least 3 days per week. Appropriate exercises include continuous rhythmic activities requiring involvement of large muscles groups. Examples are swimming, tennis, dancing and children's active games. Moderate exercise intensity in children is equivalent to heart rates of appropriately 100-120 beats per minute during an exercise session lasting 60 minutes. Vigorous exercise intensity is defined for children as a sustained heart rate of at least 120 beats per minute during an activity session lasting 60 minutes. (7,11).

Physical activity has been defined as the “bodily movement produced by skeletal muscles that results in energy expenditure”(7). Regular physical activity has significant long-term health benefits for children and youth. Activity results in reducing the risk of cardiovascular disease, cancer, hypertension, high blood lipids, diabetes and obesity. More children today are overweight or obese than ever before. “Eleven percent of 6-11 year old Americans are obese; double the prevalence of 30 years ago”(6). Physical activity is seen to reduce boredom and the tendency to turn to negative pursuits such as smoking, drug/alcohol abuse, and a crime.

"Resiliency" is a key ingredient in effectively managing both life's opportunities and challenges. Physical activity plays a role in fostering resiliency by creating better interaction with family and peers. Participating in sports associated with the ability to build self confidence, provide socializing experience for group members, including social bonding of

intimate family and friends, learning social roles, establishing and reinforcing norms of behavior, enhancing group solidarity and creating social meanings (8). “ Physical activities may enhance health by creating positive moods and intrinsic motivation, which promote a stronger sense of self-worth. Increased self-esteem can lead to a higher level of motivation and work. High self-esteem can buffer young people against adverse influences such as substance abuse and delinquent behavior. Parents, who share in joint physical activities, contribute to healthier homes and family stability. Joint child-parent activities, such as independent leisure activities have a strong relationship with satisfaction, interaction and stability. Academic performance is maintained or even enhanced by an increase in a student's level of habitual physical activity. Ongoing social relationships, including those that develop from participation in physical activity, have the potential for providing information, demonstrating expectations and cultural norms, and providing positive role models for children (4,7).

In the Republic of Armenia, physical inactivity is a public health problem, too. There are only a few public playgrounds in Yerevan where children can exercise and play games. The situation with physical education classes in Armenia is not good. In many secondary schools, there are no appropriate sport gyms or equipment for the children. During the wintertime, schools stop physical education classes because lack of the heat. In Armenia, there is lack of physical education teachers: it is common for classroom teachers to conduct physical education classes. In the outlying regions, the situation is worse: many schools do not have physical education classes at all. Because of the cost, many children do not participate in sports. There are some municipal sport schools where children can participate in sports without cost, but they still need to buy equipment, which is not cheap. However, there

are no known epidemiological studies, which have been previously been conducted on the topic in Armenia. Physical inactivity has been identified as a major risk factor for many cases of mortality and morbidity (6).

Taking into consideration all of the problems with physical activity associated with young Armenians, it is necessary to strengthen the quality physical education system in schools. This is an ideal way to encourage activity and develop fitness among children and will be their preparation for an active lifestyle (12). Physical education offers many benefits: development of the motor skills needed for enjoyable participation in physical activities; increased energy expenditures, and promotion of positive attitudes toward an active lifestyle. Evidence also exists that physical education may enhance academic performance, self-concept, mood and mental health, the promotion of physical activity may improve quality of life (10).

Quality physical education programs are essential to help students gain competence and confidence in a variety of movement forms. The International Association for Sport and Physical Education in 1995 developed standards for physical education that define a physically educated person (see fig.1). These standards acknowledge the students' motor, fitness, cognitive, affective/behavioral, and active lifestyle needs, and they focus on the importance of lifetime involvement in physical activity. They provide a sound framework for the design of physical education programs and assessments that help students learn and demonstrate their movement knowledge and skills, their fitness levels, and their habits and values related to physical fitness (13).

In September 2000, the Armenian Tennis Federation in collaboration with the International Tennis Federation started a “Mini-Tennis” program in 6 secondary schools in

Yerevan. Students in the program were first and second grade children using the standards for quality program.

Figure 1. International Physical Education Standards (IASPE, 1995)

A physically educated person

- **Demonstrates competence in many movement concepts and principles to the learning and development of motor skills**
- **Exhibits a physically active lifestyle**
- **Achieves and maintains a health-enhancing level of physical activity**
- **Demonstrates responsible personal and social behavior in physical activity settings**
- **Demonstrates understanding and respect for differences among people in physical activity abilities**
- **Understands that physical activity provides opportunities for enjoyment, self-expression, and social interaction**

* IASPE= International Association for Sport and Physical Education

The goals of this program were: to contribute to the harmonious and integral education development of children at school by building motor skills and self-confidence, to give children the tools for a longer and healthier life, to offer the opportunity to children to be introduced to tennis through mini-tennis at no cost "research has shown that middle age tennis players have significantly better health profiles than the general population" (14), and to identify talented youngsters for follow up programs (14). The Mini-Tennis program uses a game and exercise based approach employed in many countries. The target of the program is to introduce tennis to over 350 000 youngsters worldwide each year (14).

Previous research studied the influence of the Mini-Tennis program on the development of motor patterns; running, catching, jumping, throwing and hitting of children 4-7 years old. The results showed that all children significantly improved in all the motor patterns and several children improved much more than expected. There are no previous

studies comparing the performance of children taught by physical education teachers versus classroom teachers. This study provides data supporting the inclusion of physical education teachers in the schools.

The test results from the posttests will be compared with the pretests and national physical activity standards for boys and girls for 6-7 years old for identifying the difference in the performance among children and influence of different types of teachers on the children's results. The standards are included in the Table 1.

Table 1. National Standards of physical activities for 6-7 year old children (NASPA, 1995)

Activities	Boys	Girls
Running 15 meters	**3.2-3.7 seconds**	**3.4-4.0 seconds**
Jumping with feet together	**144-170 centimeter**	**130-160 centimeter**
Throwing a tennis ball	**3 times per 5 throws**	**3 times per 5 throws**
Catching a tennis ball	**3 times per 5 catches**	**3 times per 5 catches**

* NASPA= National Association of Sport and Physical Activity

Taking into consideration the poor situation regarding physical activity in Armenia, the lack of physical education teachers, and the lack of spaces and equipment in schools and communities for organizing the physical activities programs, it is justified to develop and implement a national health promotion program. And as a one of the first steps in this process, plans are to implement the Mini-Tennis program in secondary schools during the physical education classes. If this evaluation demonstrates a positive impact, the outcomes of this program could be used to justify expanding the pilot program of the schools.

Research Questions:

The research questions for this study are the following:

1. Is there any improvement in performances of 6-7 years old first grade schoolchildren after the implementation of the Mini-Tennis Program?
2. Is there any difference between the scores of 6-7 years old first grade Yerevan schoolchildren taught by physical education teachers versus classroom teachers?

Null Hypotheses

1. There is no improvement in performance of the 6-7 years old first grade schoolchildren after the implementation of the Mini-Tennis Program.
2. There is no difference between the scores of 6-7 years old first grade Yerevan schoolchildren taught by physical education teachers versus classroom teachers

Study design

The proposed study utilized quasi-experimental pre-post (panel) test design. The purpose of this study was to perform secondary data analysis of the "Mini-Tennis" program that was implemented from September to May 2000.

Sampling methodology

There are 3 Tennis Clubs in Yerevan, which are located in different districts. Initially, 9 secondary schools (3 schools for each Tennis Club) were selected by convenience sampling methods to participate in the "Mini-Tennis" program. However, 6 schools remained in the program because there were no sport gyms in 3 of them. Three of the schools have physical education teachers, while, in the other three, classroom teachers led the physical education classes. The Ministry of Education of Armenia approved the program for 2000-2002. The "Mini-Tennis" program was conducted during physical education classes once per week, lasting 45 minutes as part of the students' curriculum.

Target population

In the program there were 369 first grade students-participants from the 6 schools. The eligibility criteria of the study were:

1. First grade schoolchildren aged 6-7 years of age who participated in the physical education classes

2. Residency in Yerevan and attendance in one of the 6 selected schools.

Tests

In order to evaluate the performance of children before and after the program, they were tested at baseline and in follow-up. The following tests were performed:

- Running-15 meters
- Jumping-one long jump with feet together
- Throwing-5 overhand throws of tennis ball to a target, placed at a distance of 2 meters
- Catching-5 catches of tennis ball thrown by teacher, at a distance of 3 meters

Each test has specific items, which were demonstrated by the teacher and which the children had to accomplish (see Figure 2).

Test procedures

The Armenian Tennis Federation (ATF) organized 2 meetings for administration and teachers from the chosen schools in May 2000. The ATF Vice-President and National Coordinator of the "Mini-Tennis" program in Armenia discussed all necessary information regarding the program during those meetings. The role and functions of ATF, National Coordinator of the program, administration and teachers of the schools were clearly defined. The National Coordinator of the "Mini-Tennis" program organized training-seminars for the

teachers involved in the program. The teachers were trained in groups and individually. The classes included theoretical and practical components. The theoretical component of the instruction was implemented for all teachers from 6 schools in a 2-hour class. Teachers were informed about the importance of physical activity among children, the "Mini-Tennis" program, its goals, objectives, techniques and rules of tennis. Individually, each teacher attended and participated in 5 one-hour classes. The teaching materials used during these classes were adapted from the "ITF School Teacher's Manual" developed by International Tennis Federation. This manual was translated from English into Armenia and distributed to all teachers who participated in the program.

Figure 2. Tests specific items

Running	Eyes focused forward Bent knees during recovery phase Arms bend at elbows in opposition to legs Contact ground with front part of foot Body leans slightly forward
Jumping	Eyes focused forward or upward throughout jump Knees bent with arms behind body Forceful upward thrust of arms as legs straighten Contact ground with front part of feet and bent knees Balanced landing with no more than one step
Throwing	Eyes focused on target throughout throw Stand side-on to target Step toward target upon release Marked sequential hip to shoulder rotation Throwing arm follows through down and across body
Catching	Eyes focused on ball throughout catch Preparatory position with elbows bent and hands in front Hands move to meet the ball hands and fingers positioned correctly to catch the ball Catch and control ball with hands only and elbows bent

During the practical sessions, the teachers practiced all 30 lessons, included in the manual. Contents of these lessons include activities and games with balls, rackets, bats, hoops, ropes, balloons, and mats, and individual and group exercises. The schools also

received special "Mini-Tennis" program equipment. The equipment was donated by ITF and included tennis rackets, foam balls, and bats. Once the training was completed and the equipment obtained, the program was started.

Analysis

Data were entered into a computer database and analyzed using SPSS 10.0 software. The paired-sample t-test was used for comparing the data before and after the implementation of program. The independent-sample t-test was used to compare the mean differences in improvement between two types of teachers in. The test results from the pre and posttests were also compared with the national physical activity standards for boys and girls for 6-7 years old.

Ethical considerations:

As previously mentioned, this is a secondary data analysis study; therefore, there is no risk to participants. Given the data were collected in an ethical manner as part of routine program evaluation and considering the fact that this study uses secondary data analysis, there is no need for a consent process. Furthermore this assessment was conducted as part of routine programmatic evaluation and therefore exempt from human subjects review. Still, the proposal was reviewed and approved by the AUA College of Health Sciences Committee on Human Research. The study results can be used as a source of information for such institutions as Ministry of Health, Ministry of Sport, and Ministry of Education.

To assure confidentiality and to protect the anonymity of the subjects, during data entry and data analysis, the records were used without identifiers such as names or addresses. Only coding and ID numbers were used. The principal investigator, co-investigator, and the student researcher were the only people with access to the complete data.

The data were analyzed and stored at the CHSR (Center for Health Services Research and Development) of the AUA (American University of Armenia).

Results

A total of 369 first grade schoolchildren participated in the Mini-Tennis program. Of all participants, 51.8 percent (191) were girls and 48.2 percent (178) were boys. Of those, 65.9 percent (243) were taught by physical education teachers and 34.1 percent (126) were taught by classroom teachers. Before the program only 1.4 percent (5) of the children met the standards in all 4 tests, while after the program in 23.6 percent (87). How students performed tests before and after the program in terms of meeting standards is shown in Table 2**.**

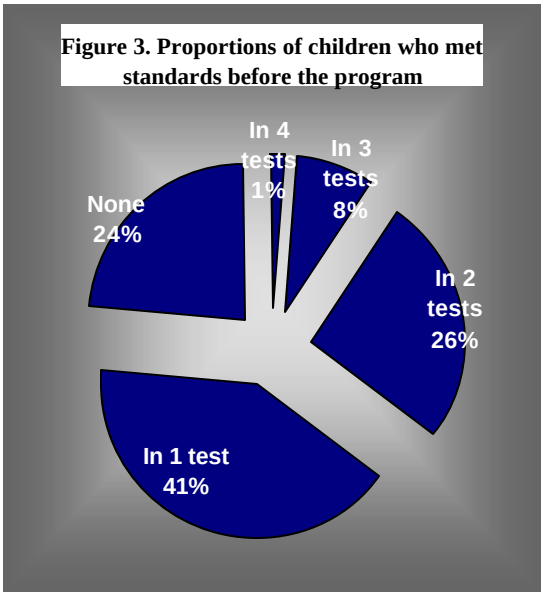
Table 2. Proportion of students who met national standards*

Met the standards in tests	Before the program	After the program
None	**23.6%**	**0.3%**
One	**41.2%**	**5.1%**
Two	**25.7%**	**22.0%**
Three	**8.1%**	**49.1%**
Four	**1.4%**	**23.6%**

* $p<0.0001$, Wilcoxon test

Thus, before the program less than 10 percent of students met standards in at least three tests, while after the program about 3/4 of them met standards in at least three tests, Wilcoxon test ($p<0.0001$). In the Figures 3 and 4 the results from Table 2 are presented for more visibility.

To answer the research question as to whether there is a difference in performance of tests before and after the program, all observations were analyzed. There was statistically significant improvement in all tests results. Mean scores of tests in all four tests were compared before and after the program. The results are shown in the Table 3.



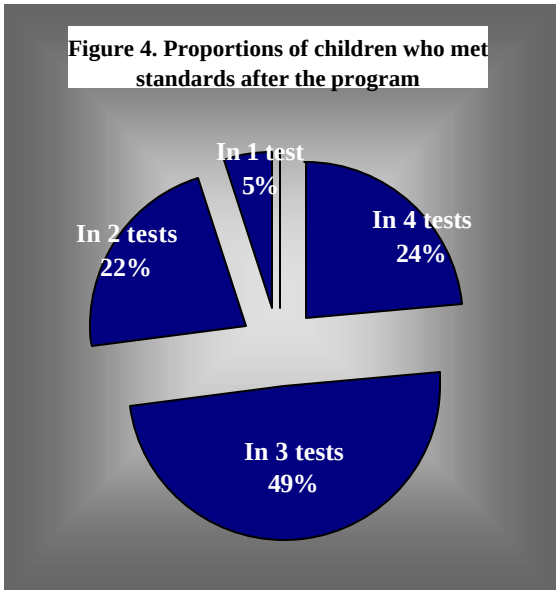


Table 3. Comparison of test results before and after the program [Mean (SD*)]

Tests	Before	After	Mean difference	p- value
Running	4.0 (0.3) sec**	3.8 (0.3) sec	0.2sec	p < 0.0001
Jumping	99.0 (26.3) cm ***	127.5 (16.6) cm	28.5cm	p< 0.0001
Throwing	1.9 (1.8) times	3.4 (1.0) times	1.5 times	p< 0.0001
Catching	2.5 (1.1) times	3.9 (0.8) times	1.4 times	p< 0.0001

* Standard deviation
** sec –seconds
*** cm- centimeter

To answer the research question as to whether there was a difference in performance between the two types of teachers, the results for all tests were compared at baseline and after the program by teacher types. Baseline characteristics of schoolchildren in performance of tests in classes with physical education teachers versus classroom teachers were about the same, when comparing the mean scores of tests. The results are shown in the Table 4.

Table 4. Baseline characteristics in performance of schoolchildren by two types of teachers [Mean (SD*)]

Tests	PE teachers	CR teachers	Difference	P-value
Running	**3.98 (0.3) sec****	**4.01 (0.3) sec**	**-0.03**	**0.293**
Jumping	**98.66 (24.6) cm*****	**99.56 (29.5) cm**	**-0.90**	**0.756**
Throwing	**1.71 (1.1) times**	**2.25 (1.2) times**	**-0.55**	**0.211**
Catching	**2.45 (1.1) times**	**2.53 (1.1) times**	**-0.08**	**0.511**

*Standard deviation
** sec –seconds
*** cm- centimeter

Classes with physical education teachers and classroom teachers were compared in performance of tests after the program as well. The results are shown in the Table 5.

Table 5. Performance of children after the program by two types of teachers [Mean (SD*)].

Tests	PE teachers	CR teachers	Difference	P-value
Running	**3.65 (0.3) sec****	**3.77 (0.3) sec**	**-0.12**	**0.000**
Jumping	**127.8 (16.1) times**	**126.7 (17.5) times**	**1.1**	**0.567**
Throwing	**3.5 (0.9) cm*****	**3.1 (1.1) cm**	**0.4**	**0.001**
Catching	**3.97 (0.8) times**	**3.7 (0.8) times**	**0.27**	**0.003**

*Standard deviation
** sec –seconds
*** cm- centimeter

Thus, in jumping and throwing the results were significantly better in classes with physical education teachers, while in running the results were better in classes with classroom teachers, and in catching there was no difference.

For more precise analysis to compare the two different types of classes, it was tested how the results were improved during the program. Statistically significant improvement was observed in throwing, catching, and running. The results are shown in the Table 6.

Table 6. Comparison of mean difference score in children taught by physical education teachers vs. classroom teachers [Mean (SD*)]

Tests	PE teachers	CR teachers	Difference	p- value
Running	**0.32 (0.18) sec****	**0.24 (0. 19) sec**	**0.08 sec**	**P < 0.0001**
Jumping	**29. 2 (18.9) cm*****	**27. 2 (18.9) cm**	**2 cm**	**P < 0.786**
Throwing	**1.8 (1.1) times**	**0.87 (1.3) times**	**0.93 times**	**P<0.0001**
Catching	**1.51 (1.25) times**	**1.17 (1.18) times**	**0.34 times**	**P < 0.01**

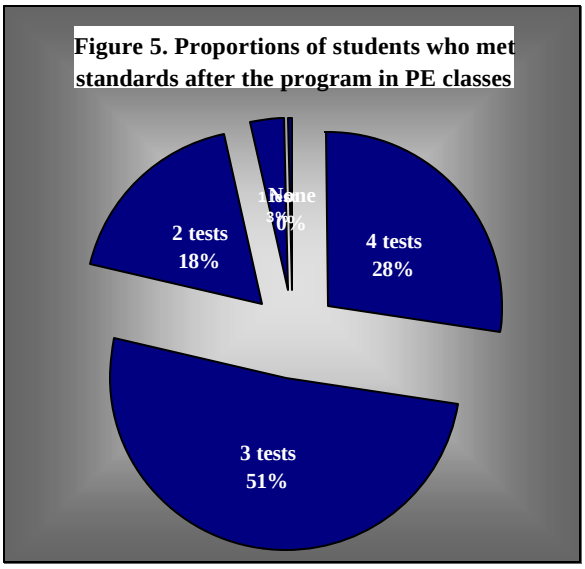
* Standard deviation
** sec –seconds
*** cm- centimeter

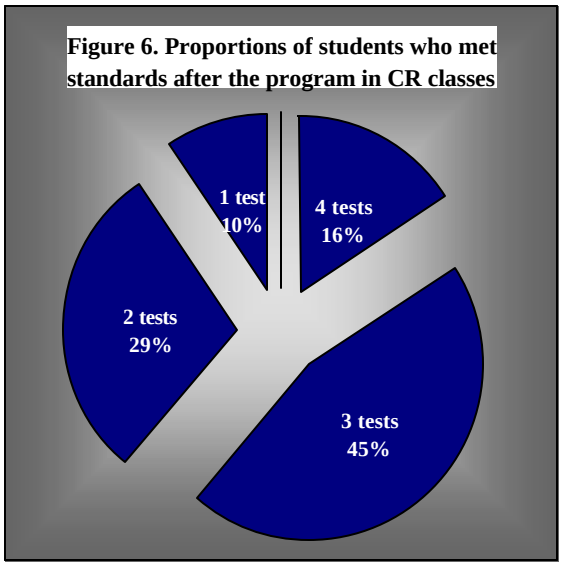
To answer the research question as it was analyzed also proportions of students who met standards in 4 different tests in classes with physical education teachers versus classroom teachers. At baseline there was no statistically significant difference, while after the program in classes with physical education teachers students met standards significantly better than in classes with classroom teachers. The results are shown in the Table 7.

Table 7. Mean number of tests in which students met standards before and after the program by two types of classes.

Classes	PE teachers	CR teachers	Difference	p-value
Before	**1.19 (0.9)**	**1.29 (0.9)**	**-0.1**	**0.315**
After	**3.02 (0.8)**	**2.67 (0.9)**	**0.35**	**0.000**

The proportion of students who met standards at least in 3 tests in classes with physical education classes was about 80 percent, while in classes with classroom teachers in 61 percent. How students met standards after the program in two types of classes are presented in the Figures 4 and 5.





The performance of tests in girls versus boys was also examined. The mean score of difference in improvement for boys and girls before and after the program was about the same in running, catching and throwing, while in jumping for girls the mean difference score was significantly higher than in boys. The results are shown in the Table 8.

Table 8. Mean difference in improvement between boys and girls [Mean (SD*)].

Tests	Boys	Girls	Difference	P-value
Running	**0.30 (0.18) sec****	**0.29 (0.20) sec**	**0.01**	**0.368**
Jumping	**23.31 (15.94) cm*****	**33.30 (20.10) cm**	**-9.99**	**0.002**
Throwing	**1.38 (1.20) times**	**1.57 (1.30) times**	**-0.19**	**0.265**
Catching	**1.44 (1.18) times**	**1.36 (1.28) times**	**0.08**	**0.477**

***** Standard deviation
** sec –seconds
*** cm- centimeter

For more comprehensive evaluation of the program all four tests were analyzed separately.

Throwing

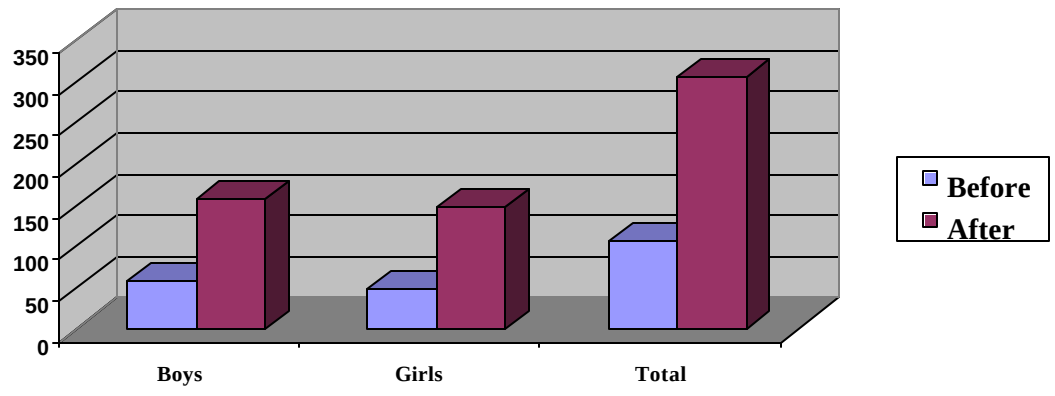
Before the implementation of the Mini-Tennis program only 29% of children, 33.1 percent in boys and 25.1 percent in girls, met the standards for throwing. After the program 82.7 percent of children met the standard in throwing, 88.8 percent in boys and 77 percent in girls. Statistically significant improvement was observed in boys as well as in girls. The results are shown in the Table 9.

Table 9. Proportions of students who met the standard for throwing before and after the program

First grade schoolchildren	Before	After	Difference	p-value
Boys	**33.1%**	**88.8%**	**-55.7%**	**0.000**
Girls	**25.1%**	**77.0%**	**-51.9%**	**0.000**
Total	**29%**	**82.7%**	**-53.7%**	**0.000**

The performance of throwing before and after the program by gender is shown in the Figure 7.

Figure 7. Number of students who met the standard for throwing before and after the program



To answer the research question as to whether there is a difference in performance before and after the program, the results for throwing were compared. The mean of throwing

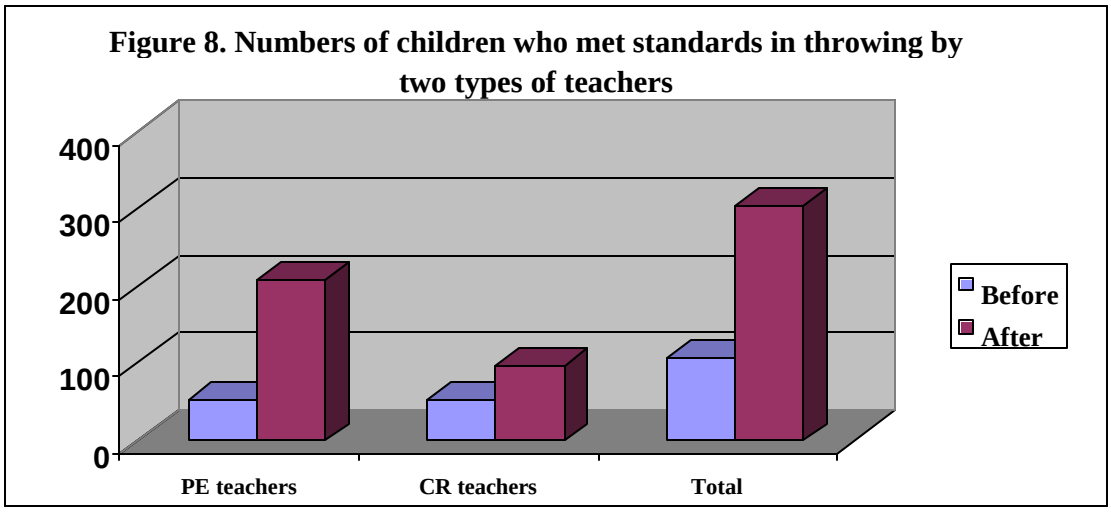
before the implementation of the program was 1.9 times (SD 1.8). After the program the mean the mean score of throwing increased up to 34 times (SD 1.0), p<0.0001. Thus, there was a statistically significant difference in performance of throwing before and after the intervention. It was compared also proportions of students who met standards in throwing before and after the program. The results are shown in the Table 10.

Table 10. Proportions of students who met the standard in throwing before and after the program in classes with two types of teachers

Teachers	Before	After	Difference	p-value
Physical education	**22.2%**	**86.0%**	**-55.7%**	**0.000**
Classroom	**42.1%**	**76.2%**	**-51.9%**	**0.000**
Total	**29%**	**82.7%**	**-53.7%**	**0.000**

To answer the research question as to whether there is a difference in performance of the test in classes with physical education teachers and classroom teachers, two types of classes were compared before and after the program. In comparing the mean scores of throwing before the program, there was no statistically significant difference between the two types of teachers [1.71 (SD 1.1) in PE teacher classes vs. 2.25 (SD 1.2) in CR teacher classes, p=0.211]. After the program the mean score of throwing in classes with physical education teachers was significantly higher than in classes with classroom teachers [3.5 (SD 0.9) vs. 3.1 (SD 1.1), p<0.0001].

Comparing proportions of students who met the standard in throwing after the program, 86.0 percent of children in classes with physical education teachers met the standard, while in classes with classroom teachers in 76.2 percent. Thus, after the program students in classes with physical education teachers performed the test significantly better than students with classroom teachers (p<0.0001). The results are shown in the Figure 8.



The mean difference in improvement in throwing for classes with physical education teachers was 1.8 (SD 1.1) times and 0.87 (SD 1.3) for classes with classroom teachers, $p<0.0001$. There was statistically significant difference between two types of teachers regarding improving the test results between baseline and follow-up.

Catching

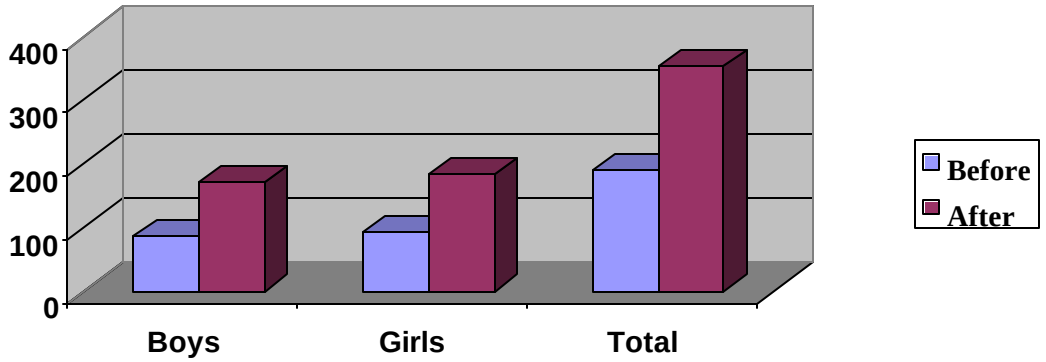
Before the implementation of the Mini-Tennis program 51.5 percent of children met the norms, 51.7 percent in boys and 51.3 percent in girls. After the program the proportion of children who met the standards increased to 95.9 percent. The results are shown in Table 11.

Table 11. Proportions of students who met the standard for catching before and after the program

First grade schoolchildren	Before	After	Difference	p-value
Boys	51.7%	96.1%	-44.4	0.000
Girls	51.3%	95.8%	-44.5	0.000
Total	51.5%	95.9%	-44.4	0.000

The performance of catching before and after the program by gender is shown in the Figure 9.

Figure 9. Numbers of students who met the standard in catching before and after the program by gender



To answer the research question as to whether there is a difference in performance before and after the program, the results for catching were compared. The mean of catching before the program was 2.5 (SD 1.1) times out of 5 catches from a distance at 3 meters. After the program, the mean score of catching was 3.9 (SD 0.8) times, $p < 0.0001$.Thus, there was statistically significant improvement in mean scores of catching in children before and after the program. Also compared whether proportions of students who met the standard in catching before and after the program. The results are shown in the table 12.

Table 12. Proportions of students who met the standard in catching before and after the program in classes with two types of teachers

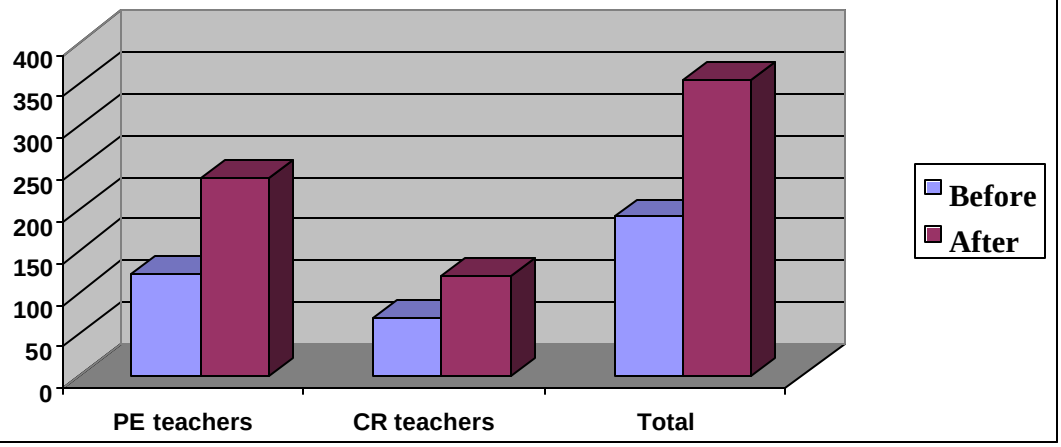
Teachers	Before	After	Difference	p-value
Physical education	**50.2%**	**97.1%**	**-46.9**	**0.000**
Classroom	**54.0%**	**93.7%**	**-39.7**	**0.000**
Total	**51.5%**	**95.9%**	**-44.4**	**0.000**

To answer the research question as to whether there is a difference in performance of catching in classes with physical education teachers versus classroom teachers, two types of classes were compared before and after the program. In comparing the mean scores of

catching before the program, there was no statistically significant difference between the two types of teachers [2.45 (SD 1.1) in classes with PE teachers vs. 2.53 (SD 1.1) in classes with CR teachers, p=0.511]. After the program the mean score of catching in classes with PE teachers was significantly better than in classes with CR teachers [3.97 (SD 0.8) vs. 3.70 (SD 0.8), correspondingly, p=0.003].

Comparing proportions of students who met standard in catching after the program, 2.9 percent of children in classes with physical education teachers did not met the standards, while in classes with classroom teachers in 6.3 percent. Thus, after the program students in classes with physical education teachers performed the test significantly better than students with classroom teachers (p=0.001). The results are shown in the Figure 10.

Figure 10. Number of students who met the standard in catching before and after the program by teachers



The mean difference in scores before and after the program in catching for classes with physical education teachers was 1.51 (SD 1.25) times, while for classes with classroom teachers the mean difference score was 1.17 (SD 1.18), p= 0.01.There was a statistically significant improvement in catching before and after the program between two types of teachers.

Jumping

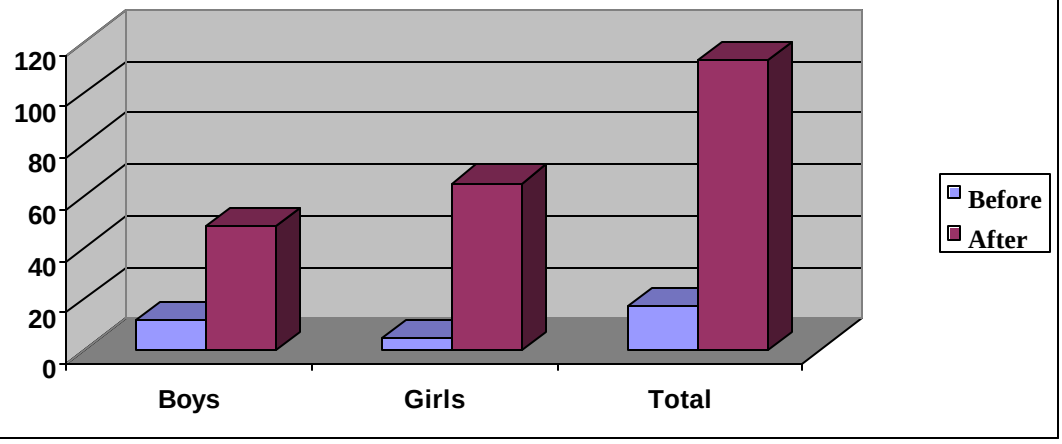
Before the implementation of the Mini-Tennis program, only 4.6 percent of children, 6.9 percent in boys and 2.6 percent in girls, met the standards in jumping. At the follow up, 30.9 percent of participants met the norms in jumping, 27.5 percent in boys and 34.0 percent in girls (see table 13)

Table 13. Proportions of students who met the standard for jumping before and after the program

First grade schoolchildren	Before	After	Difference	p-value
Boys	6.7%	27.5%	-20.8	0.000
Girls	2.6%	34.0%	-31.4	0.000
Total	4.6%	30.9%	-26.3	0.000

The number of children who met the standard in jumping before and after the program by gender is shown in the Figure 11.

Figure 11. Number of students who met the standard in jumping before and after the program by gender



To answer the research question as to whether there is a difference in performance before and after the program, the results in jumping were compared. The mean of jumping was 99.0 (SD 26.3) centimeters before the program, after the program mean was 127.5 (SD

16.6) centimeters, p< 0.0001. Thus, there is statistically significant improvement in mean scores of jumping in children before and after the program.

Proportions of students who met the standard in jumping before and after the program are shown in the Table 14.

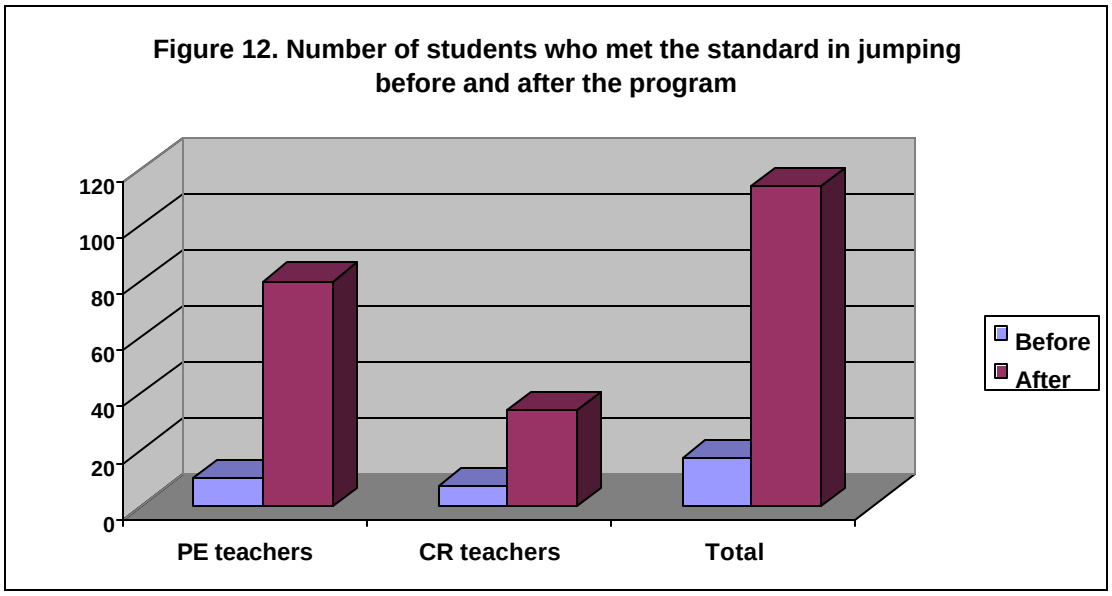
Table 14. Proportions of students who met the standard in jumping before and after the program in classes with two types of teachers

Teachers	Before	After	Difference	p-value
Physical education	**4.1%**	**32.9%**	**-28.8**	**0.000**
Classroom	**5.6%**	**27.0%**	**-21.4**	**0.000**
Total	**4.6%**	**30.9%**	**-26.3**	**0.000**

To answer the research question as to whether there was a difference in performance of jumping in classes with physical education teachers versus classroom teachers, two types of classes were compared before and after the program. In comparing the mean scores of jumping before the program, there was no statistically significant difference between the two types of teachers [98.7 (SD 24.6) vs. 99.6 (SD 29.5), correspondingly, p=0.756]. After the program, there was no statistically significant difference between classes (p=0.567), as well.

At the beginning of the program 95.9 percent of children from classes with physical education teachers and 94.4 percent of children from classes with classroom teachers did not meet the standard. At the end of the program, the proportion of students who did not meet the standard in classes with PE teachers decreased to 67.1 percent, whereas the proportion of students in classes with classroom teachers decreased to 73.0 percent. However, the difference is not statistically significant (p=0.235)

In the Figure 12 it is shown how children from classes with physical education teachers and classroom teachers met the standards in jumping before and after the program.



The mean difference in scores before and after the program in jumping in classes with physical education teachers was 29.2 (SD 18.9) centimeters, in classes with classroom teachers the mean was 27.2 (SD 18.9) centimeters, p= 0.786. Thus, there was no statistically significant difference in improvement in jumping between two types of teachers.

Running

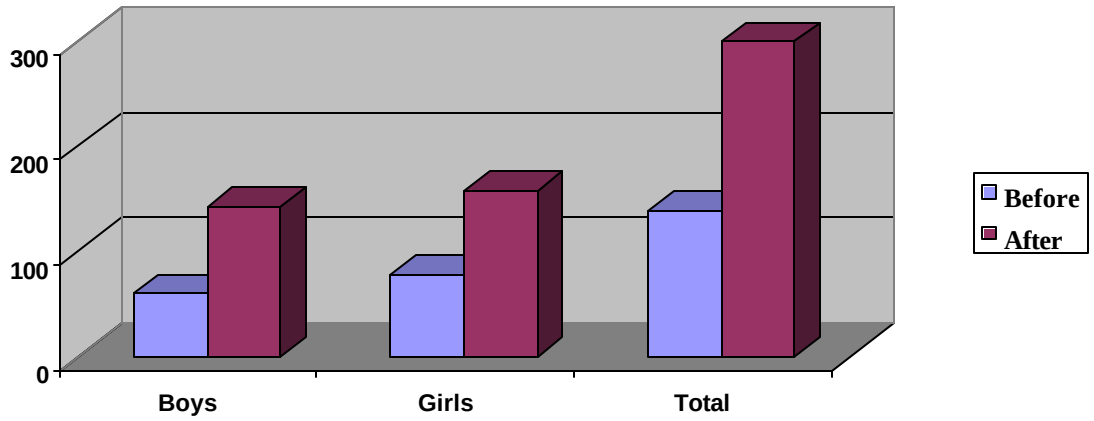
Before the implementation of the Mini-Tennis program, only 37.4 percent of children met the standards for running, 33.7 percent in boys and 40.8 percent in girls. At the end of the program, it was revealed that 81.0 percent of children met the standards, 79.8 percent of boys and 82.2 percent in girls. The results of running are shown in the table 14.

Table 14. Proportions of students who met the standard in running before and after the program

First grade schoolchildren	Before	After	Difference	p-value
Boys	33.7%	79.8%	-46.1	0.000
Girls	40.8%	82.2%	-41.4	0.000
Total	37.4%	81.0%	-43.6	0.000

The performance of running before and after the program by gender is shown in Figure 13.

Figure 13. Numbers of students who met the standard in running before and after the program by gender



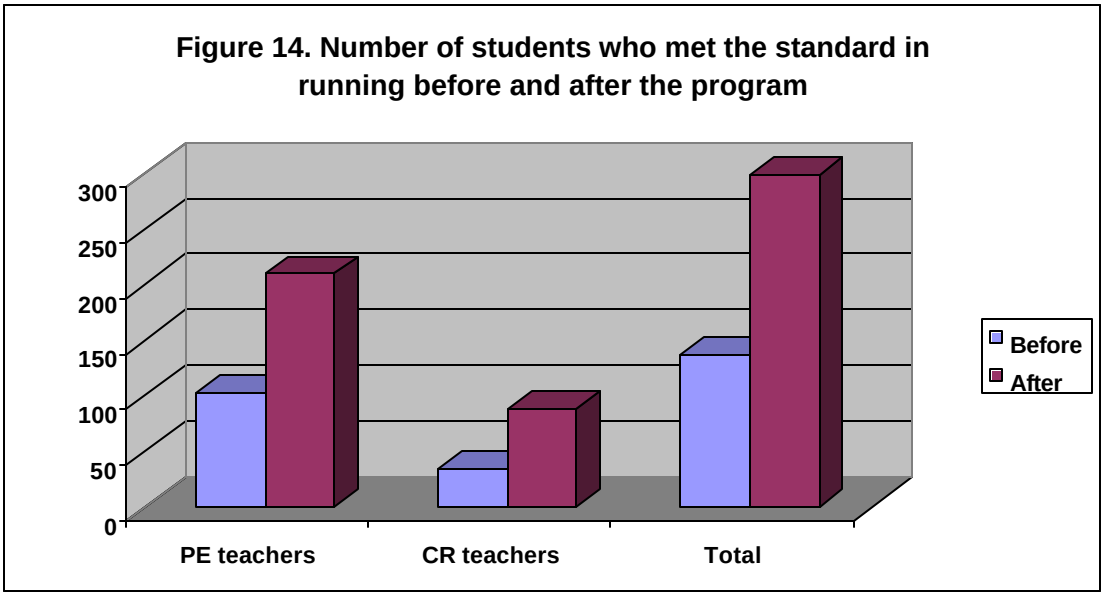
To answer the research question as to whether there is a difference in performance of running before and after the program, the results were compared. The mean of running before the implementation of the program was 4.0 (SD 0.3) seconds; while after the program the mean dropped to 3.8 (SD 0.3) seconds, $p < 0.0001$. Thus, there was a statistically significant difference in performance of running before and after the intervention. The proportions of students who met standards after the program was compared by teacher types. The results are presented in the Table 15.

Table 15. Proportions of students who met the standard in running before and after the program in classes with two types of teachers

Teachers	Before	After	Difference	p-value
Physical education	**42.4%**	**86.4%**	**-44**	**0.000**
Classroom	**27.8%**	**70.6%**	**42.8**	**0.000**
Total	**37.4%**	**81.0%**	**-43.6**	**0.000**

To answer the research question as to whether there is a difference in performance of the test in classes with physical education teachers versus classroom teachers, two types of classes were compared in scores of running before and after the program. As shown in

Table 4, there was no statistically significant difference in running before the program ($p=0.293$) comparing mean scores. However, after the program in classes with physical education teachers students performed the test significantly better than in classes with classroom teachers ($p<0.0001$). The number of students who met the standard before and after the program by teacher types is shown on the Figure 14.



The mean difference in score before and after the program in running in classes with physical education teachers was 0.33 (SD 0.18) seconds versus 0.24 (SD 0.24) seconds in classes with classroom teachers, $p< 0.0001$. Thus, there was statistically significant better improvement in running in classes with physical education teachers.

Discussion

Evaluation of the Mini-Tennis program was done based on performance of students in throwing, catching, jumping and running before and after the implementation of the program.

Among the most important findings at the baseline were that a few children met the national physical activity standards in four tests (1.4%), while after the program the proportion of students who met standards in all four tests increased up to 23.6 percent. Before the program of all students, 23.6 percent could not meet any tests, whereas at the end of the program only 1 participant (0.3%) did not meet any norm. These findings indicate that the physical inactivity among children is a correctable public health problem in Armenia. One of the ways to solve this vital problem is a promotion of physical activity among children by strengthening qualified physical education system in schools.

At the baseline in throwing, jumping and catching more boys than girls met the standards but in running girls had better results. After the implementation of the program boys met the norms better in throwing and catching, while in running and jumping girls were better

The obvious improvement in performance in all four tests after the implementation of the program was observed for all first grade schoolchildren who participated in the Mini-Tennis program.

The factors that can jeopardize internal validity, which is whether the significant improvement in the performance among children is due to the program or not, are the following

- Maturation effect: nine months growth may result in some extent in outcome.
- History: some events may affect on the study results. During winter months all schools stopped the physical education classes because of the problems with heating system.

- Instrument bias: classroom teachers got more help from national coordinator of Mini-Tennis program, who attended and assessed classroom teachers during physical education classes more often.

To reveal the difference between the baseline characteristics of schoolchildren in classes with physical education teachers and classroom teachers the mean scores of the children were compared. No significant differences were observed.

At the end of the program the mean difference scores of first grade schoolchildren taught by physical education teachers were compared with classroom teachers. The statistically significance difference in mean scores was determined in throwing, catching and running. Slightly improvement was identified only in jumping test. Thus, students in classes with physical education teachers performed tests significantly better than students with classroom teachers, although the national coordinator of the program assisted in conducting physical education lessons in classes with classroom teachers quite often.

The program was highly effective with added impact when using trained physical education teachers.

Recommendations

Due to the established effectiveness of the program and its feasibility, it is recommended to widely implement the Mini- Tennis program in Armenia either in schools during the physical education classes as part of the student's curriculum or additional physical activity promotion program. Physical education teachers should conduct the Mini-Tennis program where feasible. In case of lack of them classroom teachers should conduct the program. International Tennis Federation is ready to provide all necessary equipment free of charge for Armenia.

Taking into consideration the poor situation of physical activity in Armenia it is also suggested to conduct large-scale campaign via mass media to promote physical awareness among Armenian population. Physical activity programs should be developed in kindergartens, schools, universities, and workplaces.

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