A Study of the Physical Fitness, Perceived Value of Physical Education, and Generic Skills of Secondary School Students

中學生的體適能，對體育課的價值觀以及一般動作技巧之研究

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Abstract

Recent research findings suggested a gradual decline of physical fitness in Hong Kong school children over the past 10 years despite efforts by the Hong Kong SAR Government to promote the development of sports culture in the territory. Since cardiovascular heart disease (CHD) is the number 2 killer in Hong Kong and Hong Kong children were developing CHD risk factors prematurely, it was highly desirable to design and implement primary prevention programmes for this special population. The present study intended to provide better understanding of the physical fitness (PF), the perceived value of physical education (PV) and the contribution of physical education (PE) in the development of generic skills (GS) of secondary school students in Hong Kong. Subjects were 3,067 students from 26 schools selected by proportional stratification based on the school type and region. They were asked to perform a physical fitness test battery, and respond to two questionnaires on perceived value of PE and contribution of PE on development of generic skills. Results indicated that age was a factor: the younger group (12-14 years) scored better than the older group (15-18 years) in PV and GS. Older female subjects scored the highest in PF and also the lowest in PV, suggesting that they were fit but not because they perceived value of PE. Correlations between the three factors were significant ($p<0.05$) except in the older male group. The lowest PF score was also found in the younger male group. It was concluded that in order to facilitate the development of sports culture among school children , further studies would be desirable to better understand the phenomena that affect children and adolescents' perception of the value of PE in school and their motives and personal meaning for participation in physical activity.

Key words: Active lifestyle, Quality life, Motivation, School children.

摘　要

縱然香港特區政府是努力地推行體育運動文化之發展，近期的研究結果，卻發現在過去十年，香港學童的體適能是逐漸地下降。由於心臟病是香港的第二號殺手，而誘發心臟病的危機因子，在香港的兒童身上提早地出現了，因此，為學童們設計和進行基本的防護計劃，實在是刻不容緩。本研究報告，旨在提供一些關於香港中學生的體適能表現，對體育課的價值觀，以及體育課對發展一般動作技巧的貢獻。研究的對象來自26 所學校，合共3,067 名學生，而樣本的抽取，是基於學校的性質、地區，並以分層抽樣的方

式進行。學生們需要接受體適能測試，並填寫有關對體育課的價值觀，以及體育課對發展一般動作技巧的貢獻之問卷。研究結果顯示，年齡是一個因素：年齡介乎 12 歲至 14 歲(年輕組別)者在對體育課的價值觀方面，以及體育課對發展一般動作技巧的貢獻方面，得分較年齡介乎15歲至16歲(年長組別)者為高。年長組別的女性在體適能測試方面得分最高，在對體育課的價值觀方面得分最低，這指出她們的良好體適能，並非由於她們認同體育課的價值。在體適能表現，對體育課的價值觀，以及體育課對發展一般動作技巧的貢獻，這三方面，除了在年長組別的男性外，相互間都有顯著的相關性。而年輕組別的男性，在體適能測試方面的得分是最低。總括而言，為了推行體育運動文化在學校適當地發展，對什麼現象影響兒童和成年人對體育課的價值觀，以及他們參與體育活動的動機和個人意義，都必須加以深入研究和了解。

Introduction

The focus on the development of physical fitness has been the major concern of both developed and developing countries for the past 50 years. In the U.S., the founding of the President's Council on Physical Fitness in 1958 indicated an increased awareness of the importance of developing physical fitness in school children. In Canada, the introduction of the Lifestyle Inventory and Fitness Evaluation (L.I.F.E.) program and the Participaction campaign in 1975 further supported the importance of a healthy and active lifestyle for the general public. In Asia, the Physical Performance Tests were developed in the early 1960's and were used in the first research project on physical fitness profile of Hong Kong school children in 1982 (To, 1985). This endeavour was subsequently expanded to include assessment of health fitness in the 1990's (Fu, 1994). Recent researchers on the physical fitness of school children suggested that they were on the downward trend and the percentage of children with one or more coronary heart disease risk factors were found to be 46.3% (Fu & Hao, 2002 & 2003). In another study, it was found that over 60% of the general public was sedentary °V they exercised less than once per week (Fu et al., 1998). Since it is important to develop new strategy and prevention/intervention programmes to develop healthy and physically fit children, it would be essential to have better understanding of factors that influence them such as through PV, PF and GS. The present study intended to assess the perceived value of physical education (PV), physical fitness profile (PF) and generic skills development (GS) of school children in Hong Kong. It was a collaborative project conducted together with the Physical Education Section, Education and Manpower Bureau of the Hong Kong SAR Government.

Background

In an earlier study on the development of sports culture among 13,750 secondary school students in Hong Kong, it was found that both males and females had positive attitude toward physical activities, scoring 2.33 and 2.51 respectively in the Corbin and Lindsay Questionnaire (1997). They also rated enhancing health as their top priority. It was noted that the suicidal rate among Hong Kong children and youth has risen in recent years. Tomson et al. (2003) found that the relative risk of depressive symptoms for inactive children was 2.8 to 3.4 times higher than for active children. The need to cultivate positive interest and enjoyment in physical education was suggested by Ishee (2003) as a way to promote student participation in physical activity. PV affects students' attitude and participation in physical activity and were evaluated in the present investigation through a modified questionnaire of Soudan and Everett (1981) and Avery and Lumpkin (1987). In assessing PF, the ICHPER.SD-ASIA health- related fitness protocol was adopted but the 9 min test was used in measuring cardiovascular endurance (Fu, 1994). It was reported that there was a decline in physical fitness among school children and this might lead to premature development of coronary heart disease risk factors (Fu & Hao, 2003; Woo, 2001). Continuous assessment and monitoring of this aspect is thus imperative. In terms of GS, the Hong Kong Education Department adopted a 9-item scale for testing in schools in order to better understand the impact of various education reform measures and the contribution of physical education in developing them (Hong Kong Curriculum Development Council, 2000). This scale was used to assess the perception of our subjects on their development of the 9 generic skills (Fu et al, 2004). Testing was conducted in January-May, 2003 in 26 schools chosen by proportional stratification from a pool of willing collaborators. A total of 3,067 students ranging from 12-18 years were recruited as subjects. Correlations among the three factors and 2 x 2 ANOVA for each factor were then computed in data analyses.

Methods

Schools were selected by proportional stratification based on the school type and region. A total of 26 schools were sampled, representing 5% of the total schools in Hong Kong. For each participating school, an intact class from each grade

was selected. Data collection were conducted during physical education lessons by certified testers of the Hong Kong Physical Fitness Association and questionnaires were distributed and collected by the investigators with assistance from the school physical education teachers. Scores from various physical fitness tests were converted to standard scores for statistical analyses. PV and contribution of physical education on the development of GS by students were assessed by questionnaires (Soudan & Everett, 1981; Avery & Lumpkin, 1987; Fu et al, 2004; Hong Kong Curriculum Development Council, 2000) while PF was assessed using the modified ICHPER.SD Health-related Fitness test (Fu, 1994) (See Appendixes A, B, and C). The age and gender of subjects are presented in Figure 1 while means and standard deviations of the three tests are presented in Figure 2. The relationship among the three factors was studied through their coefficient correlations and the effects of gender and age (junior vs. senior grades) on each factor were assessed using 2 x 2 ANOVA. The Duncan Multiple Range Mean Difference Tests were then conducted to investigate mean differences if needed. The test of significance was set at 0.05 level of confidence.

Figure 1.   The Age and Gender of Subjects.

Male	
12-14 years	746
15-18 years	764
Total	1,510
Female	
12-14 years	762
15-18 years	795
Total	1,557
Both Gender	
12-14 years	1,508
15-18 years	1,559
TOTAL	3,067

Results

Distribution of the subjects by gender and age and the scores of the tests are presented in Figures 1 and 2. For each test, a composite (sum) score was computed and they were then statistically analysed. The results of the Pearson Product-Moment Correlations are presented in Table 1. Most correlations were positive and significant at the 0.01 level but they were quite low (0.099-0.381). It was found that age appeared to adversely affect such correlations between physical fitness and perceived value of PE, and physical fitness and perceived value of PE in the development of generic skills in the older male subjects.

Figure 2.   Means of Test Scores.

	Physical Fitness	Perceived Value of PE	Generic Skills
Male			
12-14 years	291.69 ± 29.07	102.42± 17.94	16.44 ± 6.68
15-18 years	303.59 ± 32.64	101.07± 16.81	16.23 ± 6.09
Total	297.71 ± 31.49	101.74± 17.39	16.33 ± 6.39
Female			
12-14 years	303.88 ± 26.35	103.07± 14.68	14.68 ± 5.16
15-18 years	307.40 ± 27.08	99.07 ± 15.25	14.15 ± 4.93
Total	305.68 ± 26.78	101.02± 15.10	14.50 ± 5.06
Both Gender			
12-14 years	301.76 ± 29.46	102.75± 16.37	15.64 ± 6.02
15-18 years	297.85 ± 28.38	100.05± 16.06	15.17 ± 5.63
TOTAL	305.53 ± 29.99	101.38± 16.27	15.40 ± 5.83

Table 1. Pearson Product-Moment Correlations between the Test Items.

	PF/PV	PF/GS	PV/GS
Male	.099[++]	.072[++]	.354[++]
Female	.102[++]	.119[++]	.304[++]
12-14 years	.151[++]	.080[++]	.381[++]
15-18 years	.068[++]	.069[++]	.277[++]
Male			
12-14 years	.155[++]	.110[++]	.384[++]
15-18 years	.065	.046	.320[++]
Female			
12-14 years	.144[++]	.114[++]	.393[++]
15-18 years	.083[+]	.135[++]	.208[++]

Keys: PF- Physical Fitness, PV– Perceived Value of PE, GS - Generic Skills

[+]   significant at 0.05 level

[++]   significant at 0.01 level

Results of the 2 x 2 ANOVA on PF scores are presented in Table 2.

Significant F ratios were obtained for the gender, age and interaction factors. Duncan Multiple Range Test for mean differences revealed that older female subjects had the highest PF score but younger male subjects scored the lowest (see Table 3). There were also significant differences between the younger (12-14 years) male subjects and the other three groups.

Table 2. 2 x 2 ANOVA Results of Physical Fitness Scores.

	SS	df	Ms	F	p
Total	281929764.9	3067			
Corrected Total	2660390.6	3066	35649.6	42.76	
Gender	49086.1	1	49086.1	58.88^{++}	<0.01
Age	45549.0	1	45549.0	54.64^{++}	<0.01
Gender x Age	133448.4	1	133448.4	16.13^{++}	<0.01
Error	2553441.8	3063	833.6		

Keys: $^{+}$ significant at 0.05 level (df = 1, 3063) = 3.84
$^{++}$ significant at 0.01 level (df = 1, 3063) = 6.64

Table 3. Duncan Multiple Range Test for Mean Differences (Physical Fitness Scores).

	M_{12-14}	M_{15-18}	F_{12-14}
F_{15-18} $\bar{x} = 307.40$	15.71^{++}	3.81	3.52
F_{12-14} $\bar{x} = 303.88$	12.19^{++}	0.29	
M_{15-18} $\bar{x} = 303.59$	11.90^{++}		
M_{12-14} $\bar{x} = 291.69$	-		

Keys: $^{+}$ significant at 0.05 level (k_2 = 4.09, k_3 = 4.30; k_4 = 4.475)
$^{++}$ significant at 0.01 level (k_2 = 5.37, k_3 = 5.60; k_4 = 5.75)

Results of 2 x 2 ANOVA on the PV scores are presented in Table 4. Significant F ratios were obtained for age and interaction factors. Results of the Duncan Multiple Range Mean Different Test are presented in Table 5. The younger age group scored better than the older group and the highest and lowest scores were also obtained by the younger (12-14 years) and older (15-18 years) female groups respectively.

Table 4. 2 x 2 ANOVA Results of Perceived Value of PE Scores.

	SS	df	Ms	F	P
Total	32330828.0	3067			
Corrected Total	811019.6	3066			
Gender	354.52	1	354.52	1.35	>0.05
Age	5493.84	1	5493.84	20.93^{++}	<0.01
Gender x Age	1347.64	1	1347.64	5.13^{+}	<0.05
Error	803703.09	3063	262.39		

Keys: $^{+}$ significant at 0.05 level (df = 1, 3063) = 3.84
$^{++}$ significant at 0.01 level (df = 1, 3063) = 6.64

Table 5. Duncan Multiple Range Test for Mean Differences (Perceived Value of PE Scores).

	F_{15-18}	M_{15-18}	M_{12-14}
F_{12-14} $\bar{x} = 103.07$	4.00^{++}	2.00^{+}	0.65
M_{12-14} $\bar{x} = 102.42$	3.35^{++}	1.35	-
M_{15-18} $\bar{x} = 101.07$	2.00^{+}		
F_{15-18} $\bar{x} = 99.07$	-		

Keys: $^{+}$ significant at 0.05 level (k_2 = 1.90, k_3 = 2.00; k_4 = 2.07)
$^{++}$ significant at 0.01 level (k_2 = 2.50, k_3 = 2.60; k_4 = 2.67)

Results of 2 x 2 ANOVA on the perceived contribution of physical education on development of GS scores are presented in Table 6. Significant F ratios were obtained for the sex and age factors. Further analyses showed that the male subjects scored higher than the female subjects and that the younger group also did better than the older group.

Table 6. 2 x 2 ANOVA Results of Generic Skill Scores.

	SS	df	Ms	F	p
Total	831173.00	3067			
Corrected Total	103960.39	3066			
Gender	2563.12	1	2563.122	77.58^{++}	<0.01
Age	162.67	1	162.67	4.92^{+}	<0.05
Gender x Age	48.46	1	48.46	1.47	>0.05
Error	101164.30	3063	33.03		

Keys: $^{+}$ significant at 0.05 level (df = 1, 2063) = 3.84
$^{++}$ significant at 0.01 level (df = 1, 3063) = 6.64

In an attempt to analyze the effects of gender and sex on the three tests, a 2 x 2 ANOVA was performed on the composite scores derived from the sum of the standard or raw scores of the three tests and results are presented in Table 7. F ratios obtained were not significant at 0.05 level of confidence.

Table 7. 2 x 2 ANOVA Results of the Combined Scores of Three Tests.

	SS	df	Ms	F	p
Total	8014717.6	3067			
Corrected Total	308965.2	3066			
Gender	38.26	1	38.26	0.38	>0.05
Age	367.32	1	367.320	3.65	>0.05
Gender x Age	42.30	1	42.30	0.42	>0.05
Error	308511.0	3063	100.76		

Keys: 0.05 (df = 1, 2063) = 3.84
0.01 (df = 1, 3063) = 6.64

Conclusions

It is generally believed that after puberty, girls tend to put on weight and body fat and thus become less fit but our findings do not support this. It was found that the highest physical fitness score was obtained by the older female group (15-18 years). However, the perceived value of physical education produced the opposite results: the lowest score was obtained by the older female group. One possible explanation might be girls who were fit might not have a high perceived value of physical education. Data analyses on skinfolds and body weight of the female subjects showed that they peaked at 15-16 years old and then declined in the next three years. This trend was not observed in the male subjects : their body weight continued to increase from 15 to 18 years although triceps and calf skinfolds were on a declining trend.

The younger group (12-14 years) scored better than the older group (15-18 years) in perceived value of physical education and contribution of physical education in developing generic skills, suggesting that their attitude towards physical education was more positive when they were younger. A similar trend was reported in a 1993 study with over 13,000 primary and secondary school students : primary school students have significantly more positive attitude towards physical activity than secondary schools students (Fu, 1993).

Daly (2002) believed that it is sensible for us to consider providing and maximizing the opportunities for young people to exercise before, during and after their school day, especially a whole-hearted approach to the promotion of life-time participation in physical activity. Wood and Hollander (2002) recommended the teaching of the spiritual component of health in the curriculum. Burgeson et al. (2003) indicated that the school physical education program in the US needed to be strengthened through public support (such as public health and education officials) and measures related to the development of lifelong physical activity in youth must be implemented. The need to provide social motivation is important in youth (Allen, 2003), especially on the cultivation of positive interest and enjoyment in physical education (Ishee, 2003). In Hong Kong, the promotion of a sports culture and active lifestyle in the general public is becoming more and more important in view of the yearning for quality life. It is also important to address the increase in suicidal rate, especially among children and youth. It is believed that the school would be the best place to initiate these endeavors together with strong community and government support.

The present study suggested that in order to facilitate the development of sports culture among school children, further research is needed to better understand the phenomena that affect children and adolescents' perception of the value of physical education in school, the incentives/attractions and barriers towards participating in physical activity, and the personal meaning and reward of being fit and healthy. Such knowledge would further facilitate the development and implementation of primary prevention programmes against CHD for this population.

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Appendix A.   Physical Fitness Test - 6 Items.

Triceps Skinfolds (mm)
Calf Skinfolds (mm)
Sit-up (number)
Sit and Reach Test (cm)
Push-up (number)
9-Minute Run (meter)

Appendix B.   Perceived Value of Physical Education Test-29 items.

Developing adequate organic vigor for performance of daily activities with skill and game

Having fun
Making more friends
Getting regular exercise
Improving self-confidence
Understanding with other people
Preventing, detecting and correcting physical defects
Developing the habit of spending a portion of time in enjoyable physical Activity
Keeping in good health and physical condition
Achieving success
Having ability to move freely with control
Providing vocational preparation
Understanding the mechanical principles of movement and the effects of exercise on the human body
Developing positive mental qualities
Developing skills in various sports
Learning activities which can be continued after school
Developing sociability and social cooperation
Developing emotional stability
Developing self-realization
Keeping weight controlled
Developing sportsmanship
Developing and maintaining sound and proper physical conditioning
Developing leadership
Maintaining an optimal level of physiological efficiency
Enhancing national identity
Developing commitment
Respect for others
Developing perseverance

Appendix C.   Contribution of Physical Education in Developing Generic Skills - 9 items.

Collaborative Skills
Communication Skills
Creativity Skills
Critical Thinking Skills
Information Technology Skills
Numeric Skills
Problem Solving Skills
Self Management Skills
Study Skills

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