

Application of the Transtheoretical Model of Exercise Behavior Change Plan in High School Students

Frank C. Pan*, and Chih-Hao Chen

Abstract—The purpose of this study is to discuss the effect of the intervention of exercise behavior change plan for high school students on study subjects' social and psychological factors and exercise stages. This research uses the transtheoretical model as the research framework. One experiment group and one control group were used in a quasi-experimental design research. The experimental group accepted health-related physical fitness course and the traditional course; the control group accepted traditional physical education course. There is a significant difference before and after the intervention in the experimental group. Karl's test shows the experimental group gained a better improvement than that in the control group. The Analysis of Covariance had shown the exercise stages ($F=7.62$, $p<0.05$), and the perceived exercise benefit ($F=16.91$, $p<0.05$) of the experimental group were obviously larger than those of the control group. There was no major effect on the perceived exercise barrier ($F=0.61$, $p>0.05$) after the intervention of exercise behavior change plan. However, the rate of high school students the practical implementation of the exercise is not high, obviously influenced by the exercise barrier. The academic and examination pressure may be the major causes of the exercise barrier in the high school.

Keywords—Transtheoretical model (TTM), High school students, exercise behavior

I. INTRODUCTION

MODERN civilization does not mean a healthy life. A lot of labor is being replaced by modern technology. Automation and mechanization of the living environment, for example, a wide range of household appliances, means of transport developed, and the development of the Internet, making the material and cultural level of people rising, the required physical and labor-intensive society very different from the past. Modern technology reduces people's physical activity, leading to declining opportunities for human activities; making sedentary lifestyle (the sitting lifestyle) replaced the previous dynamic way of life. Reduce the chances of the activities that most people live and inadequate physical activity of sedentary lifestyle and physiological function are aging recession early double blow, led to modern life, the greatest threat to health, even a physical degradation of disease.

Frank C. Pan is with the Healthcare Management Dept. at Tajen University, Yanpu, Pingtung, Taiwan 907. He was the department chair. (Correspondence phone: 886-8-7624002-3120; fax: 886-8-7378685; e-mail: frankpan@mail.tajen.edu.tw).

C. H. Chen is with the Graduate student of Leisure Management Institute of Tajen University, Yanpu, Pingtung Taiwan 907. He is currently the Chief Physician of the Internal Medicine Department of National Taitung Hospital in Taiwan (e-mail: 11m10d@yahoo.com.tw)

Among the ten major causes of death propose by department of Health of R.O.C. in 1998 [1], cancer, cerebral-vascular disease and heart disease were highest in the top three, diabetes and hypertension were also located in the fifth and ninth. More evidence that these chronic diseases have been a serious threat to people's lives [1].

Past three decades in Taiwan the main threat to health has been the tradition from infective diseases into a present of chronic diseases, physical function and degenerative diseases (such as low back pain & joint lesions). In fact, most of these conditions could be greatly improved through an appropriate amount of exercise. Engaged in regular exercise can prevent coronary heart disease (CAD) [2] by improving cardiovascular and other risk factors [3], control non-insulin-dependent diabetes mellitus (NDDM) [4], help maintaining weight [5] to gain healthy body mass index [6], and help preventing chronic diseases other than DM [7]. In other words, Adequate and regular exercise not only can improve the body's oxygen uptake, promote blood circulation, improve oxygen supply parts of the body organs, but also reduce blood fat and the heart load, prevent coronary heart disease, hypertension, diabetes and other chronic diseases.

A. High School as Golden Age

High school students are in their golden age for life. School at this stage includes a substantial amount of physical education as part of the curriculum to help students maintain good health through exercise, improve physical fitness. However, the education and examination system in Taiwan had brought high school students excessive pressure, and thus distorts the virtues of the physical education curriculum. As the core to the physical education, physical fitness is the basis for all activities. Poor physical work will affect the daily life, health and learning. Ironically, physical education in the school is found to be designed as sports skill learning, rather than physical movement and training [8].

B. TTM as Theoretical Base

This study uses the transtheoretical model (TTM) that developed by Prochaska and DiClemente in 1983[9]. This theory was used to predict the behavior change of smoking cessation. The transtheoretical model is applied to all areas of health behavior, physical activity or exercise behavior in the recent years [10]. The theory integrates ten processes of behavior change methods and the five stages of change as well as decisional balance and self-efficacy to incubate a favorable behavior, [11]. Transtheoretical model is a dynamic model; emphasizing the nature of behavioral change, covering the act

itself and behavioral intentions, but behavioral change is not all or nothing phenomenon. Exercise behavior change is also a dynamic process, in which a TTM is applicable. The main purpose of this study is to explore what the intervention of the curriculum can help improving student's stages of exercise, exercise self-efficacy, exercise barrier, and exercise benefit.

II. LITERATURE REVIEW

A. The Transtheoretical Model of Behavior Change

The transtheoretical model (TTM) was developed to combine the major psychology of behavior change theory. TTM is one of the main health promotion theories developed in 1990s and was applied in the early years to correct problematic or addictive behavior. Initially, it's applied to investigate the process of quit smoking, then become widely applied to investigate varieties of health behaviors afterward, e.g.: diet abnormalities, obesity, high-fat diet, exercise, health screening and so on.

The transtheoretical model emphasize the change of healthy behavior is a dynamic process, to build up a new behavior must pass through the change of different stages, is not "all" or "no" phenomenon, to use different methods to help in develop the new behaviors in different change stages. It may also retreat because some factors while adopt and continue a healthy behavior. This model explains that when person will have the behavior change, how to change the behavior and what are the factors that affect the behavior change. Stages of change model is the core of the transtheoretical model, is divided into five stages:

1. Precontemplation: Objects of study in this stage are not used the plan of the behavior change in the next six months; the case still did not have the motive to change at this time. Maybe: not realize that their behavior have problems or try to change previously, but failed.

2. Contemplation: Objects of study in this stage are beginning to realize their behavior problems, and intending to change behavior in the next six months; the case is not ready to participate and change the action plan at this time. Maybe: Already know advantages about change and understand the difficulties and obstacles will be encountered, but the sway between the two cases can make the case stagnation in this stage, is unable to continue to proceed.

3. Preparation: Objects of study in this stage will start to change their behaviors presently in the future (e.g.: one month) and try to take some fragmentary actions in the past, such as: to participate in the correlate course, to buy some books or participate guidance classes of sports.

4. Action: Objects of study in this stage are able to achieve: "three to five times a week, thirty minutes for each time, the exercise intensity can reach the moderate-intensity" amount of regular exercise, but the duration of the time is not reaching to six months.

5. Maintenance: Objects of study in this stage are maintaining to do the regular exercise, staying more than six months, and they do many efforts to prevent the relapse of the behavior not to do exercise.

The initial stages of changing are considering that in a linear way of moving, but many people may try a variety of different change ways before while they are not reaching the goal of behavior change afterward, some people may return to the

original certain stages of relapsing, such as: return to the contemplation from the action. Advance or retreat form to a dynamic loop moving method and modified the linear change in helical model.

B. Methods to Change

To sum up, there are ten processes of change to promote behavior change in the transtheoretical model; methods of changing may be either tangible or intangible, or the cognition level and the behavior level. There are five distinctive processes in each aspect.

1. Cognition changes. Five methods are illustrated as follow. (a) Consciousness awakens: to enhance the case for a specific reason of problem behaviors, results and the sensation of the treatment as the main axle. (b) Emotions arouse: the main purpose is to make the case think that if act appropriately, it will reduce the impact of problem behaviors. (c) Environmental re-evaluation: the main purpose is to make the case know evaluations on the social environment of their unhealthy bad habits about the cognitive and emotional. It also covers personal perception for others, played a "positive" or a "negative" role, to evaluate effects to others and surrounding if they do physical activity. (d) Self re-evaluation: the main purpose is to make the case know evaluations of self image of their unhealthy bad habits about the cognitive and emotional. (e) Social liberation: the main purpose is to enhance supporting in the social environment of the behavior change, to create a social environment that is beneficial to do regular exercise.

2. Behavioral changes. Five distinctive methods in this category are illustrated as well as follow. (a) Situational substitution: the main purpose is to look for an alternative way of the unhealthy behavior, which is to learn a healthy way to substitute for problem behaviors. (b) Aid relationships: in the certain methods of behavior change, need to believe, accept and make good use of others' support of healthy behavior change, including: caring, trust, acceptance and other social support. (c) Enhance management: the ways of enhanced management including enhanced methods of tangible and intangible. If not exercise is relapsing, should be limiting or stop. (d) Self liberation: including the personal's faith and promise of doing the regular exercise, not only believe they have the ability of the regular exercise behavior, but also promise their will to do the regular exercise. (e) Stimulus controls: try to increase suggestions about the change of the healthy behavior, and remove incentives of the unhealthy behavior.

The integration of stages of changing and methods of changing is emphasizing that when a person is intending to change their behavior, should integrate stages with methods of changing to use proper ways at correct time (Marcus, King, Clark, Pinto & Bock, 1996), such as: to help the case to enter contemplation from precontemplation can use methods of consciousness awaken, emotions arouse, environmental re-evaluation; for those people who is in action, should use methods of enhance management, aid relationships, situational substitution, stimulus controls to promote them to maintain the behavior [11].

III. RESEARCH METHODS

A. Research Design

This study uses a quasi-experimental design, the experiment group and the control group took the pretest and the post-test to proceed. Experimental treatment is the experiment group receives the traditional physical education to combine with health physical fitness curriculum plans; the control group receives experimental treatment of traditional physical education curriculum. Both experimental and control groups were treated with the 8-week course.

B. Object of Study

In this study, 50 high school students were taken from a public high school in Taiwan as the research object. Students are randomly divided into two groups, experiment and control.

C. Research Tools

1. Self-efficacy for Exercise of the scale, a total of thirty questions. Mainly measured by five-point Likert-type Scale designed to assess their main measurement of the object in different contexts, but also to grasp the extent of regular exercise[12].

2. Perceive Exercise Barrier of the scale, a total of thirty questions. Mainly measured by five-point Likert-type Scale designed to assess their main measuring the movement of the individual and the environment perceived barriers, but also to grasp the extent of regular exercise.

3. Perceive Exercise Benefit of the scale, a total of thirty questions. Mainly measured by five-point Likert-type Scale designed to assess their main measuring including physiological, psychological and social interests.

4. Exercise Stage Instrument reference to adapt the exercise stage scale of Cardinal (1997)[13], and according to the concept of change stage in the transtheoretical model, to compile the five stages of exercise options of precontemplation, contemplation, preparation, action, and maintenance.

IV. RESULTS

This study the experimental group and control group basic information, including gender, age, perceived health status, served as community and school teams to participate in sports clubs, sports injuries, etc., by Chi-square test required no significant differences.

A. Exercise Stage

Table I shows pre-test, the case of regular exercise in orders to "Precontemplation" the most, accounting for 50%.

TABLE I
DISTURBANCE AND HOMOGENEITY OF THE EXERCISE STAGE
(N=50)

Group	Exp. Group n=25 n (%)	Con. Group n=25 n (%)	Total n (%)	χ^2 (p)
Item				
Precontemplation	12(48)	13(52)	25(50)	2.226
Contemplation	3(12)	2(8)	5(10)	(.694)
Preparation	3(12)	2(8)	5(10)	
Action	5(20)	3(12)	8(16)	
Maintenance	2(8)	5(20)	7(14)	

The distribution of the various exercise stage was no significant difference between the two groups.

B. Homogeneity

The homogeneity of the social-psychological factor between two groups during pretest is computed, as shown in table II. The average raw score are 39.34, 39.86, and 33.02 with standard deviation at 5.26, 4.31, and 8.54 respectively. There was no significant difference of the social-psychological between the two groups.

TABLE II
THE HOMOGENEITY OF THE SOCIAL-PSYCHOLOGICAL FACTOR

Group	Exp. (n=25) Mean (sd)	Control (n=25) Mean (sd)	Total (n=50) Mean (sd)	T (p)
Item				
Self-Efficacy	40.04(4.9)	38.64(5.5)	39.34(5.26)	0.94(.352)
Exercise Barrier	39.96(4.1)	39.76(4.6)	39.86(4.31)	0.16(.872)
Exercise Benefit	33.4(8.9)	32.64(8.3)	33.02(8.54)	0.31(.757)

C. Behavior Change after Intervention

The differences before & after the intervention of exercise behavior change plan, as shown in the table III, the "Precontemplation" and the "Contemplation" are deemed to have no intention to exercise regularly. "Preparation" is considered to be prepared to exercise regularly. "Action" and "Maintenance" are considered to have regular exercise. Karl test shows the experimental group 8.96 (df = 2) (p = 0.011 < .05); control group 10.16 (df = 2) (p = 0.006 < .05). There was significant difference before & after the intervention of exercise behavior change plan in experimental group. But there was no significant difference before & after the intervention of exercise behavior change plan in control group.

D. The Effectiveness of the Intervention

The effectiveness of the intervention of exercise behavior change plan could be found in detail in the table IV. It shows some effect on self-efficacy after the intervention of exercise behavior change plan. There was a significant difference (F=7.62, p<0.05), adjusted mean of the experimental group was 41.17 and the control group was 38.49. There was no major effect on the perceived exercise barrier after the intervention of exercise behavior change plan. There was no significant difference (F=0.61, p>0.05), adjusted mean of the experimental group was 40.45 and the control group was 39.80. There was some effect on the perceived exercise benefit after the intervention of exercise behavior change plan. There was a significant difference (F=16.91, p<0.05), adjusted mean of the experimental group was 37.13 and the control group was 32.51.

V. DISCUSSIONS

The effect of the intervention program is obvious. The experimental group, there are 12 students in the "Precontemplation" stage, three for the "Contemplation", another three in the "Preparation", five in "Action", and 2 students in the "Maintenance" stage before the intervention apply. After the intervention, six students of the same group remain in the "Precontemplation", four for "Contemplation",

11 students in "Preparation", and 2 for "Action" and "Maintenance" respectively. There is a clear effect before & after the intervention plan in experimental group.

There was a significant difference on self-efficacy and the perceived exercise benefit after the intervention of exercise behavior change plan, in a total of two sets of pre-test variables for the analysis of covariance. There was no significant difference on the perceived exercise barrier after the intervention of exercise behavior change plan. The results of this trial and other subjects for adult experimental results are very different. Study, whether high school students or adults can understand most of the benefits of exercise. However, the rate of high school students the practical implementation of the exercise is not high, obviously influenced by the exercise barrier. The academic and examination pressure may be the major causes of the exercise barrier in the high school.

TABLE III
BEFORE & AFTER THE INTERVENTION OF EXERCISE BEHAVIOR
CHANGE PLAN (N=50)

Exp. group	Pre-test n (%)	Post-test n (%)	Con. Group	Pre-test n (%)	Post-test n (%)
Precontemplation	12(48)	6(24)	PC	13(52)	11(44)
Contemplation	3(12)	4(16)	CT	2(8)	2(8)
Preparation	3(12)	11(44)	PP	2(8)	5(20)
Action	5(20)	2(8)	AC	3(12)	3(12)
Maintenance	2(8)	2(8)	MN	5(20)	4(16)

TABLE IV
ANALYSIS OF COVARIATES

Variable		ANCOVA				Adjusted mean	
	Source	SS	df	MS	F	Con	Exp.
Self Efficacy	Groups	86.49	1	86.49	7.62***	38.49	41.17
	Error	522.40	46	11.36			
Exercise Barrier	Groups	5.00	1	5.00	.61	39.80	40.45
	Error	378.94	46	8.24			
Exercise Benefit	Groups	266.29	1	266.29	16.91***	32.51	37.13
	Error	724.22	46	15.74			

VI. CONCLUSIONS

High school is the golden age for life. One of the main objectives of physical education is to help students maintain good health through exercise, improve physical fitness. However, the school and examination system may be the major causes of the exercise barrier in the high school in Taiwan. Developing the good habit of regular exercise is time dependent. Long involvement with the track, can be more detailed understanding of the persistence of regular exercise of high school students.

ACKNOWLEDGMENT

The authors thank to the support offered by the colleagues of the National Taitung Hospital.

REFERENCES

- [1] Department of Health, *The Summary Results of Causes of Death Statistics in Taiwan*. Taipei: Department of Health employees consume cooperatives, 1998.
- [2] S. G. Wannamethee, A. G. Shaper, and M. Walker, "Physical activity and mortality in older men with diagnosed coronary heart disease," *Circulation*, vol. 102, 12, pp. 1358-1363, 2000.
- [3] W. Drygas, T. Kostka, A. Jegier, and H. Kunski, "Long term effects of different physical activity levels on coronary heart disease risk factors in middle-aged men," *Internal Journal of Sports medicine*, vol. 21, 4, pp. 235-241, 2000.
- [4] I. Japery, S. G. Wannamethee, M. K. Walker, A. G. Thompson, P. H. Whincup, and A. G. Shaper, "Prospective study of risk factors for development of non-insulin dependent diabetes in middle aged British men," *British Medicine Journal*, vol. 310, pp. 560-564, 1995.
- [5] T. Byers, "Body weight and mortality," *New England Journal of Medicine*, vol. 333, 11, 723-724, 1995.
- [6] B. Sternfeld, J. Cauley, S. Harlow, G. Liu, and M. Lee, "Assessment of physical activity with a single global question in a large, multiethnic sample of midlife women," *American Journal of Epidemiology*, vol. 152, 7, pp. 678-687, 2000.
- [7] B. H. Marcus, S. W. Banspach, R. C. Lefebvre, J. S. Rossi, Carleton, R. A., and D. V. Abrams, "Using the stages of change model to increase the adoption of physical activity among community participants. American," *Journal of Health Promotion*, vol. 6, pp. 424-429, 1992.
- [8] M. L. Chuang, *Physical Fitness Instructional Design*. Edited by School Sports Research and Development Center, National Taiwan Normal University. Teacher's fitness guide, pp. 189-206, 1993.
- [9] J. O. Prockaska, and C. C. DiClemente, "Stages and processes of self-change of smoking: Toward a more integrative model of change," *Journal of Consulting and Clinical Psychology*, vol. 51, pp. 390-395, 1983.
- [10] S. L. Lin. *The Study that Application of the Transtheoretical Model to physical activity, subjective and objective evaluation*. Institute of Health Education, National Taiwan Normal University, unpublished doctoral dissertation, 2000.
- [11] J. O. Prochaska, C.A. Redding, and K. Evers, "The transtheoretical model and stages of change. In Glanz, K., Lewis, F. M., and Rimer, B. K. (Ed.) *Health Behavior and Health Education (2nd. Ed.)*. CA: Jossey-bass Publishers, 1997.
- [12] A. Bandura, "Self-efficacy: Toward a unifying theory of behavior change," *Psychological Review*, vol. 84, pp. 191-215, 1997.
- [13] B. J. Cardinal, "Construct validity of stages of change for exercise behavior. American," *Journal of Health Promotion*, vol. 12, 1, pp. 68-74, 1997.