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# A Structural Equation Model Examining the Cultural Relevance of Physical Self-Concept and Self-Esteem in Chinese Children

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**Abstract**

**Objectives:** The purposes of this study were to investigate: (1) whether three subscale scores (i.e., body fat, appearance, and strength) and the global physical self-concept and global self-concept scores of the Physical Self-Description Questionnaire (PSDQ) are applicable to Chinese children; (2) whether there is a gender difference in these relationships; and (3) whether global physical self-concept acts as a mediator of global self-concept.

**Method:** 320 Chinese children aged 7-12 years were recruited. The PSDQ was used to assess two global dimensions (global physical self-concept and global self-concept) and three specific dimensions (body fat, appearance, and strength) of self-worth. The children's version of the silhouette matching task (SMT) was adopted from Marsh and Roche (1996) to measure children's body perception.

**Results:** The factor structure of the modified PSDQ model was applicable in young Chinese children, regardless of their gender. Results of structural equation model (SEM) indicated that the model was acceptable. The structural paths of the model and the mediating effect of global physical self-concept on global self-concept were discussed.

**Conclusion:** The present study indicates that the physical self is an increasingly important correlate of self-esteem. It is particularly important relative to perceived self-presentation and social acceptance. Therefore, it is important to consider the impact of the physical self-concept on global self-concept from both cultural and worldwide perspectives.

**Keywords:** body image, appearance, self-concept, Chinese children

## Introduction

The terms self-concept and self-esteem are often used interchangeably (Shavelson, Hubner, & Stanton, 1976). However, in the context of this paper, it is important to distinguish between the two terms. Self-concept refers to the descriptors or labels that an individual attaches to him- or herself, often related to physical attributes, behavioral characteristics, and emotional qualities. Self-esteem refers to how a person *perceives* and *evaluates* him or her self within the context of experiences and the environment (Shavelson et al., 1976). It is different from self-concept in that it consists of qualitative judgments and feelings attached to a person's description of oneself.

Marsh and Roche (1996) extended the definition of global self-concept by proposing that it is a hierarchical, multi-dimensional, and global construct. Global self-concept is at the apex of the hierarchy, followed by second order aspects of self-concept that are academic (e.g., math, english) and non-academic (e.g., social, emotional, and physical). Physical self-concept can be global (e.g., a combination of health, coordination, physical activity, body fat, sports competence, appearance, strength, flexibility, and endurance scores) or specific (e.g., consisting of individual subscale scores) (Fox, 1997). This paper is designed to examine various aspects of physical self-worth relative to global self-concept in Chinese children.

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Fox (1998) proposed that one's perception of his or her physical self is related to global self-concept. Sonstroem (1997a) believed that when individuals experience a more favorable perception of themselves due to exercise participation, they feel better about themselves and maintain exercise behavior longer. Results of a meta-analysis by Spence, McGannon & Poon (2005) demonstrated that over 60% of the studies reported significant and positive associations between global self-concept and physical activity involvement. The strong relationship between global self-concept and physical activity makes this an important area of study in exercise psychology.

Marsh and Roche (1996) extended the notion of global physical self-concept and included body fat, appearance, strength, and body ratings (actual vs. ideal) as significant correlates of global self-concept. Due to the cultural stigma associated with obesity or overweight status, it is logical that body fat is a strong correlate of global self-concept (Crandall, 1991; Harter, 1985, 1986; Marsh, 1990; Marsh & Roche, 1996). Related to body fat are self-rated appearance and body size (e.g., actual versus ideal). Given the emphasis on the body beautiful in Western culture (Negrin, 2004), and the often inaccurate perception of actual versus ideal body size in Western society (Conneely, 2004), it is important to consider both appearance and body rating as possible correlates of global self-concept. Strength is also related to global self-concept because individuals, particularly males, who feel stronger and more muscular report higher global self-concept (Smolak, 2006). Individuals who consider themselves strong may also feel more confident about being successful in exercise or physical activity settings (Cuddihy, Michaud-Thompson, & Jones, 2006).

In Western cultures such as the United States, United Kingdom, New Zealand, and Australia (Drummond, 2001; Dunton, Jamner, & Cooper, 2003; Fox, 1997; Marsh & Roche, 1996), correlates of global self-concept include global physical self-concept, body fat, appearance, body size, and strength. It is not clear whether these same correlates of global self-concept are evident in Eastern cultures (Sue, 1999). Because the prevalence of obesity in Asia is lower than that of most Western cultures, it is possible that correlates of global physical self-concept are different. However, obesity in Chinese cultures is continually rising (e.g., from 11% in 1993 to 18% in 2005) (Department of Health, 2005; Leung, 1993) and physical activity participation is low and frequently considered dispensable compared to other endeavors (Adab & Macfarlane, 1998; Guldan, Cheung, & Chui, 1998). It is worthwhile to compare global physical self-concept, body fat, appearance, body size (actual vs. ideal), and strength as correlates of global self-concept in Western and Eastern countries to determine whether the increased prevalence of obesity and globalization of society has influenced correlates of global self-concept in Eastern countries (Kowner, 2002).

When applying the existing correlates of global self-concept to the Chinese, two major cultural factors are worth considering. First, in traditional Chinese culture, "plump" is sometimes considered the desirable physique because it represents familial wealth and fame (Jing, 2000). Heavier Chinese individuals may have higher global self-concept and global physical self-concept than those who are underweight. A second concept worth considering is that Chinese men and women report lower global self-concept compared to their Western counterparts (Davis & Katzman, 1997).

In addition to examining the aforementioned relationships in adults, it is worthwhile to examine these correlates of global self-concept in children. It is possible that the relationship between global self-concept and global physical self-concept, body fat, appearance, body size, and strength is present in Chinese children, just as it exists in children from Western culture (Crocker, Snyder, Kowalski, & Hoar, 2000b; Rees & Brandl-Bredenbeck, 1995). Interestingly, a recent study by Lau, Lee, Ransdell, Yu, and Sung (2004) demonstrated that the body size discrepancy rating of Chinese children was not predictive of global physical self-concept and global self-concept. These findings are contrary to previous findings with Western children and they imply that culture plays a key role in defining the relationship between body size rating and global physical self-concept or global self-concept.

Gender differences in the factors related to global self-concept are another area worthwhile of study. Given that the Chinese culture often celebrates male accomplishments above female accomplishments (Mjelde-Mossey & Walz, 2006) and that male and female ideals of beauty are often different (Furnham, Badmin, & Sneade, 2002), it is important to study gender differences in correlates of global self-concept.

Building upon the preliminary research of Lau et al., (2004), the researchers of the present study attempted to advance the aforementioned areas of research by employing structural equation modeling (SEM) to test the psychometrics of the PSDQ in Chinese children. Based on previous findings of Marsh and Roche (1996), it is hypothesized that body fat, muscular strength, and appearance will have direct and indirect influences on global self-concept through global physical self-concept. Actual and ideal body shape ratings are expected to have an impact on global physical self-concept, thus they are used as predictors. Age is also used as a predictor here because in previous studies, global physical self-concept and global self-concept changed throughout a child's growth and development until young adulthood (Marsh, 1998).

Research questions for this study are: (1) Are the body fat, appearance, and strength subscales and global physical self-concept of the PSDQ applicable to 7-12 year old Chinese children?, (2) Are there any structural and mean differences among the constructs between boys and girls?, and (3) Does global physical self-concept mediate the effects of body fat, appearance, and strength on global self-concept?

## Method

*Participants*

Three hundred and twenty Chinese children (45% girls, 55% boys) aged 7-12 years from low to middle class families were recruited as participants. Participants attended grades 3 through 6 at a standard urban primary school in Hong Kong. Children in this study represented a socio-economically matched population from Hong Kong. Specifically, the majority of the children lived in government estates, had free time after school for activities, and benefited from good financial support from their families (Hong Kong Census and Statistics Department, 2005).

Prior to the start of the study, permission to conduct the study was obtained from the aforementioned school. Additionally, participants and their parents were given consent letters, which explained the aims and procedures of the study. Children were reminded that their participation in the study was voluntary and they could withdraw at any time without any negative repercussions. All participants and their parents consented to participate in the study by providing written approval.

*Measures*

Global self-concept and global physical self-concept were measured using the PSDQ (Marsh, Richards, Johnson, Roche, & Tremayne, 1994). The theoretical framework and design of the PSDQ were based on the well-established multidimensional Self-Description Questionnaire. Psychometric properties of the PSDQ have been validated in diversified cultures including Australia, Spain, and Turkey (Marsh et al., 1994; Marsh, Marco, & Abcy, 2002). The PSDQ demonstrates acceptable internal reliability, short and long term test-retest reliability, and convergent and discriminant validity with other physical self-concept instruments (Marsh et al., 2002). Additionally, external validity criteria reflecting body composition, physical activity, and other components of physical fitness were demonstrated (Marsh et al., 2002). Hau, Sung, Yu, & Lau (2002) conducted a study using the PSDQ in Chinese children and the reliabilities (ranged from 0.67 to 0.92) were a bit lower than in the original study (Marsh, et al, 1994), but can be improved substantially by deleting items with low item-total correlations. Confirmatory factor analyses indicated a convergent solution, well defined parameters and acceptable subjective fit indexes, which suggests that the western factorial structure can be applied to a Chinese sample.

The PSDQ contains 70 items designed to measure nine specific components of global physical self-concept (health, coordination, physical activity, body fat, sports competence, appearance, strength, flexibility, and endurance). Global physical self-concept and global self-concept are also measured. Each of the 70 PSDQ items is a simple declarative statement that requires an answer on a 6-point Likert-type scale with answers ranging from 1 to 6 (false, mostly false, more false than true, more true than false, mostly true, and true). Because the present study is based on Marsh and Roche's (1996) hypothesis that body fat, appearance, strength, body ratings, and global physical self-concept are significant predictors of global self-concept, we chose to use only 5 scales from the PSDQ. These scales include two global measures (e.g., global physical self-concept and global self-concept) and three specific measures (e.g., body fat, appearance, and strength). Sample items from the global self-concept scale and global physical self-concept scale are "Most things I do, I do well." and "Physically, I am happy with myself." An example of an item from the body fat subscale of physical self-concept is "I am too fat."

For measuring body rating (actual vs. ideal), the children's version of the silhouette matching task (SMT) was adopted from Marsh and Roche (1996). For this task, children were presented with a set of silhouette pictures of 9 girls and 9 boys. Pictures ranged from very thin to very obese. Respondents were asked to choose the silhouette that

was most like them (actual) and the silhouette that was most like their perceived ideal body. Hau et al. (2002) previously established the validity of the SMT in Chinese obese and normal weight children. Obese children perceived that they had more body fat and were larger than their non-obese counterparts. The perception of body size was accurate and reflected group differences between body weights and shape.

PSDQ items were used as indicators for their corresponding latent variables in SEM. Negatively worded items were reverse scored. The SMT was scored by using the number of the silhouette chosen by each child. Scores ranged from 1 (very thin) to 9 (very obese). Two types of body ratings were used in this study: actual and ideal body ratings. Both the PSDQ and SMT were translated into Chinese using the translation-back translation method (Hau et al., 2002; Lau et al., 2004).

*Procedures*
Students took approximately 40 minutes to complete the questionnaires during physical education classes. The first author distributed the questionnaires and explained the objective of the study, with the assistance of regular classroom teachers. Children were told that their questionnaires were not "scored," there were no right or wrong answers, and all data would be destroyed after the study and could be accessed by only the first author. Children were asked to work on their answers individually without discussing anything with their classmates. Out of the 320 surveys distributed, 291 (91%) were completed and returned.

*Statistical Analysis*
To answer the first research question, whether the model of Marsh and Roche's (1996) is applicable to Chinese children, multiple-group confirmatory factor analysis (CFA), a special case of SEM, was used to test the measurement invariance of different models in both gender groups. After establishing the measurement invariance, to test the second research question, multiple-group SEM with mean structure (e.g., Little, 1997) was used to compare the latent mean differences on the constructs between the gender groups. Finally, multiple-group SEM was used to test the third research question, related to whether global physical self-concept fully mediates the effects of body fat, appearance, and strength on global self-concept. Several goodness-of-fit indices were reported to assess the adequacy of model fit: The critical value for the comparative fit index (CFI) and incremental fit index (IFI) was > 0.9 and the critical value for the root mean square error of approximation (RMSEA) was < 0.10 (Hair, Black, Babin, Anderson & Tatham, 2006).

*Treatment of Missing Data*
Missing data were minimal in this study. The largest number of missing cases was 15 (less than 5%). Missing data were handled using the full information maximum likelihood estimation method implemented in LISREL.

*Measurement Invariance Over Gender*
Before comparing the structural relationships by gender, it is necessary to establish the invariance properties of the questionnaire (Bollen, 1989). Measurement invariance refers to whether the questionnaires measure the same constructs in male and female children. CFA is widely used to establish measurement invariance (Cheung & Rensvold, 1999; Little, 1997; Marsh, 1993). The items of global self-concept, global physical self-concept, body fat, appearance and strength were analyzed with a CFA model allowing the latent factors to be correlated. Cheung and Rensvold (1999) list four levels of measurement invariance. These include: (1) invariance of factor form, (2) invariance of factor loadings (3) invariance of covariance matrices of the latent variables and (4) invariance of variance matrices of the measurement errors. Invariance of factor loadings is a necessary condition for valid comparison of mean differences across different groups (Bollen, 1989).

Besides using chi-square difference test to compare the models, the recommendations of Marsh et al. (2002) were followed and the RMSEA was used rather than the formal chi-square difference test. The CFI and IFI, which are proposed as goodness-of-fit indices for comparing nested models, are also reported (Cheung & Rensvold, 2002). Small changes (-0.01 for CFI) in goodness-of-fit indices in these nested model comparisons (Cheung & Rensvold, 2002) would suggest that the constrained models are still very good.

*Latent Mean Differences Over Gender*

After establishing the measurement invariance, we tested the latent means of body fat, appearance, strength, global physical self-concept and global self-concept between boys and girls by using the mean and covariance structures analysis. No significant difference existed, $\Delta\chi^2_{(5)} = 14.47$, $p = .01$, between the model of unequal latent means, $\chi^2_{(911)} = 1,650.76$, $p < .001$, RMSEA = .075, CFI = .91 and IFI = .91, and the model of equal latent means, $\chi^2_{(916)} = 1,665.23$, $p < .001$, RMSEA = .081, CFI = .91 and IFI = .91. The goodness-of-fit indices between these two models were comparable. Therefore, the latent means of the five constructs were similar across gender.

*Structural Model*

After establishing the measurement invariance properties, theoretical directions on the latent constructs can be proposed. Fitting a measurement model before a structural model follows the two-step approach (e.g., Hair et al., 2006). If the model does not fit the data, we can disentangle the non-significant variables from the model and infer that their lack of inclusion in the model is due to measurement problems or structural problems. After fitting the structural model in different gender groups, we can further test whether the structural relationships are the same in different groups by imposing the equality constraints on the structural paths. LISREL 8.72 (Jöreskog & Sörbom, 2005) was employed to conduct the structural equation modeling analysis.

## Results

*Descriptive Statistics*

Table 1 showed the correlation matrix and the descriptive statistics of the variables.
Table 2 presented the means and standard deviations of the variables separated by gender groups.

[INSERT TABLES 1 & 2 ABOUT HERE]

*Measurement Invariance Over Gender*

*Baseline model (invariance of factor form).* The original five factor model containing global self-concept, global physical self-concept, body fat, appearance and strength did not fit the data in boys and girls ($\chi^2_{(908)} = 1,829.39$, $p < .001$, RMSEA = .084, CFI = .89 and IFI = .89). This lack of fit suggested that the model (invariance of factor form) did not fit adequately in young male and female Chinese children. By checking the modification indices (Jöreskog & Sörbom, 2005), two interpretable changes were made. First, two items ("I am satisfied with the kind of person I am physically." and "I am weak and have no muscles."), intended to measure global physical self-concept and strength, respectively, were double-loaded on body fat. This suggested that young children tended to confuse these two items relative to body fat. Second, the measurement errors of eight negatively worded items were correlated. This was consistent with previous findings that the method artifacts of negatively worded items were sometimes observed in personality measures (e.g., Horan, DiStefano, & Motl, 2003; Quilty, Oakman, & Risko, 2006), especially in younger children with less verbal ability (Marsh, 1986).

The modified model fitted better in Chinese children than the original model ($\chi^2_{(884)} = 1,568.06$, $p < .001$, RMSEA = .073, CFI = .91 and IFI = .91), and it was statistically better than the original one with $\Delta\chi^2_{(24, n = 291)} = 261.33$, $p < .0001$. Although the fit indices of the modified model were considered marginal rather than excellent, we used this model as the baseline model for comparing the measurement invariance because the modified model was theoretically interpretable. The results of the comparisons were shown in Table 3.

[INSERT TABLE 3 ABOUT HERE]

*Invariance of factor loadings.* When comparing the models of invariance of factor loadings and factor form, the chi-square difference test showed that it was statistically non-significant ($\Delta\chi^2_{(29)} = 40.13$, $p = .08$). Moreover, RMSEA, CFI and IFI suggested that the model fit of the modified model was similar to that of the original one in terms of factor form invariance. Thus, the invariance model of factor loadings seemed acceptable (Cheung & Rensvold, 2002).

*Invariance of factor covariance matrices and error variance matrices.* By further constraining the equality on factor covariance matrices in the samples of boys and girls, the chi-square change did not increase significantly ($\Delta\chi^2_{(15)} = 22.41$, $p = .12$). The chi-square change reached statistical significance ($\Delta\chi^2_{(42)} = 69.76$, $p = .005$) when the equality on error variance matrices were constrained. The other goodness-of-fit indices (RMSEA, CFI & IFI) did not change

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within two decimal places when the equality on factor covariance matrices and error variance matrices were constrained. Thus, the lack of large changes in these values suggested that measurement invariance properties were stable across gender groups and reliability was similar between genders. In summary, the PSDQ measured the same constructs in male and female children.

*Latent Mean Differences over Gender*

After establishing the measurement invariance, we tested the latent means of body fat, appearance, strength, global physical self-concept and global self-concept between boys and girls by using the mean and covariance structures analysis. The goodness-of-fit indices of the model with unequal latent means were $\chi^2_{(911)} = 1,650.76$, $p < .001$, RMSEA = .075, CFI = .91 and IFI = .91 while the goodness-of-fit indices of the model with equal latent means were $\chi^2_{(916)} = 1,665.23$, $p < .001$, RMSEA = .081, CFI = .91 and IFI = .91. By using the chi-square difference test, the difference was not statistically significant ($\Delta\chi^2_{(5)} = 14.47$, $p = .99$). Therefore, the latent means of the five constructs were not statistically different across gender.

*Structural Model*

Figure 1 showed the parameter estimates of the structural model. Since the factor loadings were only required to be invariant when comparing the structural model, we allowed the measurement errors to be free in the male and female groups and the model fits adequately ($\chi^2_{(1,079)} = 1,877.98$, $p < .001$, RMSEA = .072, CFI = .90 & IFI = .90). To test whether these structural paths were the same in male and female groups, equality constraints on the structural paths were applied universally. The model fit was similar to the fit of the model without equality constraints on the structural paths with $\chi^2_{(1,090)} = 1,894.39$, $p < .001$, RMSEA = .071, CFI = .90 & IFI = .90. When the chi-square difference test was examined, the models were not statistically different ($\Delta\chi^2_{(11)} = 16.41$, $p = .13$). Thus, there was strong evidence that the structural paths were the same in male and female groups. The structural path estimates and their standardized solutions were shown in Table 4.

[INSERT FIGURE 1 AND TABLE 4 ABOUT HERE]

**Discussion**

*Invariance of Factor Form and Loadings*

The first research question asked: "Are the body fat, appearance, and strength subscales and global physical self-concept of the PSDQ applicable to 7-12 year old Chinese children?" Based upon the results of the modified model and resulting factor form, factor loadings, factor covariance matrices and error variance matrices, the factor structure of the three subscales of global physical self-concept, global physical self-concept and global self-concept are deemed useful and applicable in young Chinese children aged 7-12 years when investigating the associations between different components of physical self-concept (Marsh & Roche, 1996). Body fat, appearance, and strength subscales, and global physical self-concept and global self-concept are valid for young Chinese children. Our findings agree with Marsh and colleagues (2002) who validated the PSDQ in Turkish, Spanish and Australian students. Findings from the current study also confirm that Marsh and Roche's (1996) concepts of body fat, appearance, and strength are significant contributors to global self-concept in Chinese culture. Finally, this study offers preliminary support for the application of the PSDQ in Chinese children younger than 12 years of age.

*Invariance over Gender*

The second research question asked: "Are there any structural and mean differences among the constructs between boys and girls?" Our findings, which are consistent with Marsh et al. (1994), suggest that the modified model is invariant for both boys and girls, indicating that the questionnaire measures the same construct in males and females. It is possible that young Chinese males and females have not been significantly influenced by the "body beautiful" aspect of Western culture. It is also possible that the success of Chinese women in recent Olympics has facilitated societal changes such that physical expectations are more similar than ever for male and female children.

*Mean Differences of Constructs*

Marsh (1998) indicated that there were substantial gender differences in adolescents for the subscales of PSDQ including body fat, appearance, strength, global physical self-concept and global self-concept subscales. Our findings do not agree with most previous findings--that boys are more physically active and have higher physical self-perception than girls - especially in the strength and sport competence sub-scales (Crocker, Eklund, & Kowalski, 2000a; Hayes, Crocker, & Kowalski, 1999; Mota & Silva, 1999; Raudsepp & Pall, 1999). Marsh (1998)

explained that these gender differences systematically favor males and are consistent with traditional stereotypes between boys and girls. When examining recent Chinese studies, Hau, Sung, Yu, Marsh and Lau (2005) indicated a small gender difference, with boys having higher physical self-concept scores compared to their female counterparts. Lau et al. (2004) also demonstrated that boys scored significantly higher than girls on global physical self-concept --- especially in the sport competence, strength and endurance subscales.

The recent development of extreme body image concerns in both young boys and girls might partially explain the non-significant differences in body and appearance scores across gender (Huk-Wieliczuk, 2001). Many previous studies have documented that boys and girls become obsessed with body weight, shape, appearance, size. Therefore, body dissatisfaction in both genders is increasing. Females want to become slimmer and males want to have more muscle mass (Drummond, 2001; Hayes et al., 1999; Hilhorst, 2002; MacKinnon et al., 2003; Smith, Handley, & Eldredge, 1998).

Another possible explanation for the lack of gender differences in this sample is that the participants were young (Moode & Wiggins, 1999). It is possible that a gender difference is more likely after girls and boys reach adolescence (Ball, Marshall, Roberts, & McCargar, 2001). Children may place more importance on other self-concept dimensions (e.g., academic or social) at this age (Fox, 1997). In the current study, no definitive answer can be obtained, thus further investigation is needed.

*Structural Model and the Mediating Role of Global Physical Self-concept*
The third research question asked: "Does global physical self-concept mediate the effects of body fat, appearance, and strength on global self-concept?" Several findings are worth noting. First, body fat does not have a direct effect on global self-concept; thus it must work through global physical self-concept to affect global self-concept. Conversely, appearance and strength do have a direct effect on global self-concept. Even after controlling for the effects of global physical self-concept, children with higher scores on appearance and strength had higher global self-concept.

These findings are contrary to those of Crocker et al., (2000a or b) who demonstrated an independent contribution of body fat to global self-concept but not from appearance. Marsh and Roche (1996) indicated that while body fat and appearance may be correlated with global self-concept, there is not a direct or indirect contribution of fat or appearance to global self-concept. According to the theoretical postulates of the PSDQ, the hierarchical structure suggests an indirect relationship between the higher order construct (global self-concept) and lower order constructs (i.e. physical self-concept subscales). The present findings indicate that global physical self-concept does not fully mediate the effect of appearance and strength on global self-concept. Thus global physical self-concept may not be a necessary element when considering the impact of appearance and strength on global self-concept among Chinese children.

We did not replicate the effects of appearance and strength on global self-concept, as was proposed in the original theoretical model of Marsh et al. (1994). The two additional paths suggested by our research are an extension of the existing theory of self-concept proposed by Shavelson et al. (1976) and Marsh et al. (1994). Our findings imply that appearance and strength go beyond physical influences on global physical self-concept. They transmit a global sense of impact to the apex of personal global self-concept.
These proposed direct paths need further explanation. First of all, body appearance in the modern society is more than a physical concept. It represents a global body culture consisting of individual lifestyles, social relationships and daily behaviours (Berg, 1997; Parizkova & Hills, 2001). Rees and Brandl-Bredenbeck (1995) named this concept "body capital" when it was operationally defined as physical appearance. This implies that "body capital" influences an individuals' global self-concept. For example, body dissatisfaction, body perfectionism, body prejudice, body discrimination, depression, anxiety, eating disorders, and other mental risks are exacerbated by one's body size concern, without considering one's physical abilities (British Nutrition Foundation, 1999; Gotwals, Dunn, & Wayment, 2003; Thompson & Smolak, 2001).

When considering the direct contribution of strength to global self-concept, recent studies have found that perceived athletic competence, sport competence beliefs, and strength training are associated with levels of global self-concept without the mediator effect of global physical self-concept (Ebbeck & Weiss, 1998; Gotwals et al., 2003; Martino & Short, 1999; McNeely & Armstrong, 2002; Rose & Larkin, 2002). Although some studies have indicated that the

influence of strength on global self-concept is minor compared to the influence of physical appearance on global self-concept, the unique and direct impact of perceived strength on global self-concept is supported (McDonough, 2003; Rodriguez, Wigfield, & Eccles, 2003).

Interestingly, in this study, the covariate age had no significant effect on global self-concept or global physical self-concept. Our findings are in agreement with the most recent study by Marsh (1998) who reported that age did not have a significant effect on an adolescent's global physical self-concept. It is possible that young children, such as those in our study and the study by Marsh (1998), are not sensitive enough to consider the association between body fat and global self-concept. Previous studies by Shavelson et al. (1976), Marsh (1989), and Marsh and Craven (1997) found that that global self-concept did differ with age. These conflicting findings regarding the effect of age on global self-concept and global physical self-concept support the need for additional research.

## Conclusions and Future Directions

The factor structure of the modified PSDQ model was applicable in young Chinese children, regardless of gender. These findings extend previously established theories and models related to global self-concept to the Chinese culture. From previous studies, Lau and colleagues (2004) demonstrated that the body size discrepancy rating of Chinese children was not predictive of global self-concept and global physical self-concept. They also showed that the appearance, strength, health, and body fat sub-scale scores significantly predicted global self-concept from the regression analysis. The present study replicated the finding that appearance and strength have a direct and indirect effect on global self-concept. Since these findings are different from those reported in Western literature, cultural elements deserve an in-depth investigation regarding the formation of body attitude. The study of Hau et al. (2005) tested the applicability of all subscales of PSDQ between obese and normal weight Chinese children. In the present study, the focus is more on the mediating effect of global physical self-concept between body perception and global self-concept in normal weight children. As a result, only the variables related to body perception were included, and this approach was adopted based upon the previous research of Marsh and Roche (1996). Because the physical self is becoming an increasingly important correlate of global self-concept - important to perceived self-presentation and social acceptance - it is important to consider the impact of the physical self on global self-concept from a worldwide perspective. If we can accurately determine the factors related to global self-concept and cross-validate those findings in many cultures, we can further our understanding of improved mental health.

Although the modified PSDQ model was applicable in young Chinese children in the present study, more studies are needed to identify the mechanism and its changes between physical self-concept, global self-concept and physical activity. Furthermore, the current findings call for more researches to examine the domain-specific changes in the self hierarchy, especially in the Chinese traditional understandings and its recent developments of global self and physical self. Moreover, longitudinal study should be conducted to examine and document the developmental changes over time regarding the self and physical activity. Therefore, the modified model would be more persuasive when applying in Chinese children. Since no objective measures of the children's level and types of physical activity were conducted in the present study, it is advisable to use these measures in future studies (Dunton et al., 2003). Finally, interventions can be conceived based on the understanding of the associations between global self-concept changes and Chinese children's physical activity participation. To conclude, the present findings are only a start on this area and the modified PSDQ model in Chinese children should be explored further and refined in order to demonstrate its applicability among non-western cultures.

Although several novel findings were reported, readers should be reminded that the data supporting the model were cross-sectional. Therefore, it is difficult to justify the directions of the paths empirically. Longitudinal studies, which provide a stronger test of the casual directions (e.g., Collins, 2006; Raudenbush, 2001), may be required to test the validity of the model in the future. Furthermore, the developmental issue related to the applicability of the PSDQ in younger Chinese children should be explored further since factors such as age can be influential when using this scale.

In closing, it is important to note that the present study indicates that the physical self is becoming an increasingly important correlate of global self-concept. It is particularly important relative to perceived self-presentation and social acceptance. To enhance global self-concept, global physical self-worth, and other aspects of body image, researchers and practitioners should consider the impact of the physical self on self-esteem from both cultural and worldwide perspectives.

Although this study has reported several unique findings, it is not without limitations. First, our findings are limited to Hong Kong Chinese children aged 7-12 years from low to middle class families. Future studies should examine the relationship between body perception and global self-concept in different age groups like younger children, and from other socio economic strata. It is possible that maturation stage and/or higher socio-economic status may differentially affect the aforementioned relationships. Additionally, this study was cross-sectional in nature. Future studies should include longitudinal data and/or they should use the information from this study to design studies that will examine the effects of body perception on a child's physical self and global self-concept.

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Table 1
Correlation Matrix and Descriptive Statistics

|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| (1) Age | 1.00 | | | | | | | | |
| (2) Gender | -.02 | 1.00 | | | | | | | |
| (3) Self-esteem | -.10 | .02 | 1.00 | | | | | | |
| (4) Global physical self-concept | -.25** | .11 | .45** | 1.00 | | | | | |
| (5) Body fat | .12* | .09 | -.21** | -.35** | 1.00 | | | | |
| (6) Appearance | -.24** | .07 | .49** | .55** | -.24** | 1.00 | | | |
| (7) Strength | -.09 | .16* | .42** | .51** | .07 | .43** | 1.00 | | |
| (8) Actual body rating | .10 | -.06 | -.02 | -.07 | .57** | -.07 | .20** | 1.00 | |
| (9) Ideal body rating | .02 | -.05 | -.01 | .04 | -.09 | -.06 | -.01 | .25** | 1.00 |
| Means | 9.75 | .57 | 4.09 | 4.10 | 2.49 | 3.34 | 3.83 | 6.59 | 6.64 |
| SD | 1.54 | .50 | .98 | 1.36 | 1.46 | 1.19 | 1.14 | 1.78 | 1.52 |

*Notes.* $* p < .05. ** p < .01.$

Table 2
Means and Standard Deviations of Variables by Gender Groups

| Variables | Female | | Male | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| Self-esteem | 4.07 | .99 | 4.10 | .96 |
| Global physical self-concept | 3.94 | 1.43 | 4.22 | 1.29 |
| Body fat | 2.33 | 1.38 | 2.61 | 1.50 |
| Appearance | 3.25 | 1.18 | 3.41 | 1.19 |
| Strength | 3.61 | 1.02 | 3.99 | 1.20 |
| Actual body rating | 6.72 | 1.72 | 6.49 | 1.83 |
| Ideal body rating | 6.73 | 1.50 | 6.57 | 1.54 |

Table 2
Means and Standard Deviations of Variables by Gender Groups

Table 3

Goodness of Fit Indices for the Model Comparisons

| Invariance models | $\chi^2$ | df | $p$ value | $\Delta\chi^2$ | $p$ value for $\Delta\chi^2$ | RMSEA | CFI | IFI |
|---|---|---|---|---|---|---|---|---|
| Factor form (baseline) | 1568.06 | 884 | < .001 | | | .073 | .91 | .91 |
| Factor loadings | 1608.19 | 913 | < .001 | 40.13 | .08 | .073 | .91 | .91 |
| Factor covariance matrices | 1629.60 | 928 | < .001 | 22.41 | .12 | .072 | .91 | .91 |
| Error variance matrices | 1699.36 | 970 | < .001 | 69.76 | .005 | .072 | .91 | .91 |

*Notes*. The chi-square difference ($\Delta\chi^2$) tests are compared with the previous model.
RMSEA = root mean square error of approximation; CFI = comparative fit index; IFI = incremental fit index.

Table 4

Parameter Estimates of the Structural Paths for Esteem and Global Physical Self-concept

| Dependent variables | Self-esteem | | Global physical self-concept | |
|---|---|---|---|---|
| Independent variables | Original scale | Standardized solutions | Original scale | Standardized solutions |
| Body fat | .07 | .12 | -.32** | -.35 |
| | (.03) | | (.06) | |
| Appearance | .21** | .22 | .40** | .26 |
| | (.08) | | (.12) | |
| Strength | .31** | .38 | .77** | .60 |
| | (.11) | | (.13) | |
| Age | .05 | .09 | -.07 | -.08 |
| | (.02) | | (.04) | |
| Actual body rating | | | .08 | .10 |
| | | | (.05) | |
| Ideal body rating | | | -.01 | -.01 |
| | | | (.04) | |
| Global physical self-concept | .29* | .45 | | |
| | (.09) | | | |

*Notes.* Values in parentheses are their standard errors.

$* p < .05. ** p < .01.$

Figure caption
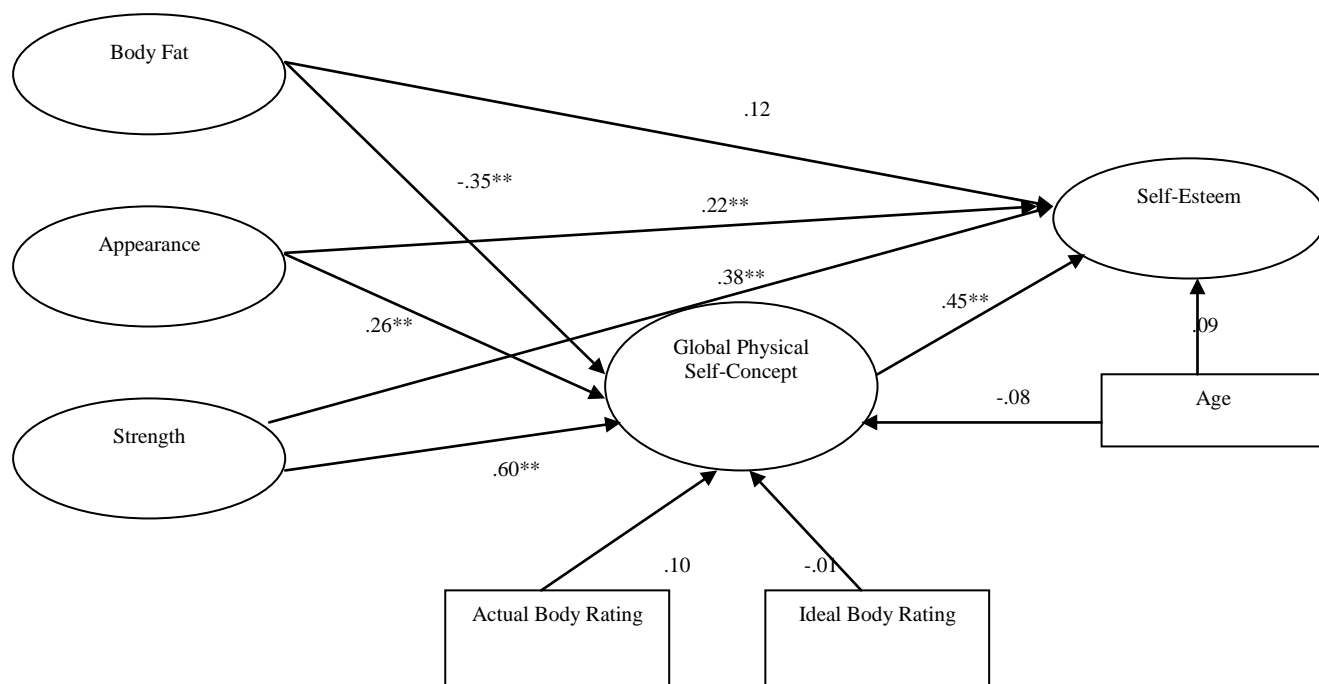*Figure 1.* Standardized structural coefficients for global physical self-concept and self-esteem.

*Figure 1*. Standardized structural coefficients for global physical self-concept and self-esteem.
*Notes*. ** $p < .01$.

To narrow the focus of the figure, the indicators of the latent constructs are not shown. Additionally, covariance among the independent variables and disturbances of the dependent variables are not displayed. In Figure 1, ellipses and rectangles represent the latent and observed variables, respectively.