Genetic and Environmental Influences on Self-Concept in Female Preadolescent Twins: Comparison of Minnesota and Seoul Data

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It has been argued that culture significantly influences the developmental basis of self-concept. The goal of the present study is to compare the relative importance of genetic and environmental factors to explain individual differences in various dimensions of self-concept in female preadolescents of Minnesota in the United States and Seoul in South Korea. Two hundred and eighteen monozygotic (MZ) and 137 dizygotic (DZ) twin pairs from the Minnesota Twin Family Study (MTFS) and 74 MZ and 42 DZ twin pairs from the Seoul Twin Family Study (STFS) completed the 6 cluster scales of the Piers–Harris Children's Self-Concept Scale (P–H). The 6 cluster scales of the P-H include Popularity, Physical Appearance and Attributes, Behavior, Intellectual Competence and School Status, Anxiety, and Happiness and Satisfaction. Univariate model-fitting analyses were performed. In both samples, a model incorporating shared and nonshared environmental influences fitted the data best for Popularity, Anxiety, and Intellectual Competence and School Status, whereas a model including additive genetic and nonshared environmental factors provided the best fit for Physical Appearance and Attributes, and Behavior. The univariate model did not yield an adequate fit for Happiness and Satisfaction. For Physical Appearance and Attributes, and Intellectual Competence and School Status, estimates of additive genetic and environmental factors were significantly different between the MTFS and the STFS samples. For Popularity, Anxiety, and Behavior, however, the genetic and environmental estimates were comparable between the two samples.

Self-concept, defined as a person's perception of him- or herself, typically makes reference to how one feels about one's worth across evaluative dimensions such as social, academic and physical domains (Shavelson et al., 1976). Self-concept is associated with diverse psychological traits and disorders. For example, personality (Graziano et al., 1997; Jeong, 2003), school performance (Coopersmith, 1967), substance abuse (Walitzer & Sher, 1996), adolescent interpersonal problems (Kahle et al., 1980), major depression (Brown et al., 1990) and eating disorders (Ingham et al., 1986) have been demonstrated to be correlates of self-concept.

Americans and Europeans, on average, have higher levels of self-concept than Asians (Kitayama et al., 1997; Markus & Kitayama, 1991). Previous studies have argued that ethnic differences of self-concept arise because of different sources of self-value in various cultures. Western cultures are organized according to meanings and practices that promote the independence and autonomy of self. The self in western cultures is meaningful primarily in reference to one's internal attributes, such as thoughts, feelings, capabilities, and action. Positive individuation, confidence, and one's personal distinguishing achievements are, therefore, important sources of self-concept for westerners. In contrast, Asian cultures generally do not value individuation and autonomy of self. Asian cultures emphasize modesty and self-criticism, and are organized according to meanings and practices that foster connectedness and interdependence among individuals within a significant relationship (e.g., family, classroom, school, work). Thus, interpersonal relationships are considered to be central to self-concept in Asians (Markus & Kitayama, 1991).

A series of acculturation studies provides evidence that engagement in North American culture fosters the development of a positive self-concept, whereas participation in Japanese culture lowers the self-concept (Heine et al., 1999). Heine et al. (1999) measured the self-esteem of visiting Japanese exchange students in Canada a few days after their arrival, and then again 7 months after their arrival, and compared the scores. The average self-esteem scores of the visiting Japanese students increased significantly (1.8 points) over this period. As a complementary study, the authors measured the self-esteem of the Canadian English teachers who went to live in Japan before they left Canada and then again

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7 months after arriving in Japan. The Canadian teachers exhibited a significant decrease (1.0 points) in self-esteem over this period of time. In another study, the authors classified over 4000 Canadian and Japanese students on a continuum with respect to their exposure to North American culture from Japanese who had never been outside Japan to third generation Asian-descent Canadians. This classification resulted in a very clear relation between exposure to North American culture and self-esteem such that the longer those of Asian descent had spent in North American culture, the higher their self-concepts to the point that the scores of third generation Asian Canadians were not different from those of European-descent Canadians.

Although culture may exert a significant impact on the formation of one's self-concept, individuals within a given culture will vary in the extent to which they construe self in the culturally mandated way. The main goal of the present study is to compare genetic and environmental sources of individual differences in various dimensions of self-concept between samples from Minnesota in the United States and Seoul in South Korea. Copious studies of psychosocial determinants of self-concept have been published so far. However, only a few studies examined genetic and environmental sources of individual differences in self-concept.

McGuire et al. (1999) investigated self-concept among Caucasian adolescent male and female twins and siblings (age 10 to 18 years) longitudinally in two measurement sessions approximately 3 years apart. McGuire et al. (1999) found that across the seven scales of Harter's Self-Perception Profile for Adolescents, age- and gender-corrected estimates of heritability ranged from 16% to 71% at the first wave and from 25% to 61% at the second wave. Shared environmental effects were zero or near zero for the seven scales at both time points. For all seven scales, the largest component of variance was that of nonshared environment, which explained from 28% to 83% of the variance at the first wave and from 30% to 68% of the variance at the second wave.

Kuo et al. (2004) studied genetic and environmental influences on self-concept in Chinese adolescent twins whose ages were similar to those of the twins in McGuire et al.'s study (1999). Kuo et al. (2004) showed that genetic influences on four domains of competence (activity, social, school and total) measured on the Child Behavior Checklist (CBCL) ranged from 12% to 54% for males and from 24% to 64% for females; shared environmental influences from 13% to 68% for males and from 7% to 48% for females; and nonshared environmental influences from 19% to 35% for males and from 23% to 34% for females. A comparison of McGuire et al.'s (1999) Caucasian sample and Kuo et al.'s (2004) Chinese sample suggests that overall, heritability estimates are similar between Chinese and Caucasian twins, but shared environmental influences are higher and nonshared environmental influences lower in Chinese twins compared to Caucasian twins. Kuo et al. (2004) also found significant gender differences in the estimates of genetic and environmental factors on some specific scales, pointing out that future analyses of self-concept should be carried out separately by genders.

On the basis of Caucasian female preadolescent twins born in Minnesota, Hur et al. (1998) reported heritability estimates of 19% to 42% on six specific domains of self-concept. These estimates were somewhat lower than those found by McGuire et al. (1999). It may be that Hur et al. (1998) found lower heritabilities because twins in Hur et al.'s study were younger than those in McGuire et al.'s study (1999). Shared environmental estimates in Hur et al.'s Caucasian sample were small, and for all six domains of self-concept, the largest component of variance was that of nonshared environment.

In summary, at present it is difficult to make any substantial conclusion on whether or not genetic and environmental contributions to individual differences in self-concept are comparable between Asians and westerners because behavior genetic studies of self-concept conducted so far have examined Asians and westerners separately using different instruments of self-concept.

The present study is the first attempt to compare the genetic and environmental factors in various dimensions of self-concept using American and South Korean female preadolescent twins simultaneously. As American and South Korean preadolescent twins in the present study completed the same instrument of self-concept that included six domains, it was possible to examine which specific domains of self-concept were similar and/or different as well as to what extent genetic and environmental factors in various self-concept dimensions were different between South Korean and American preadolescent girls.

Materials and Methods

Sample

The present sample consisted of female preadolescent twins from the Minnesota Twin Family Study (MTFS) and from the Seoul Twin Family Study (STFS). The MTFS is a longitudinal, population-based study of genetic and environmental influences on adolescent adjustment and development. Twins in the MTFS were ascertained from birth records obtained through the Minnesota State Health Department, and were then located and recruited by mail and telephone. Twin participants in the MTFS were predominantly (greater than 98%) Caucasian. The STFS is a longitudinal twin study of genetic and environmental influences on the behavioral development of children and adolescents in Seoul, South Korea. Twins were ascertained from all private and public schools in Seoul through the Seoul Metropolitan Office of Education. The ascertainment procedure and other details of the MTFS and the STFS are described in Iacono and McGue (2002) and Hur (2002), respectively.

The zygosity of twins in both studies was determined by the twins' parents' responses to the zygosity questionnaire designed for each study. The questionnaires for both studies include questions on physical similarities and how often the twins are confused by family members and others. When compared to serological tests, the questionnaire method to determine zygosity has yielded over 90% accuracy (Lykken et al., 1990; Ooki et al., 1993).

The MTFS data for the present analyses were collected from mail responses of the female twin cohort (11 and 12 years of age) where both twin members completed the Piers–Harris Children's Self-Concept Scale (P–H; Piers, 1976), explained below. The MTFS sample consisted of 218 monozygotic (MZ) and 137 dizygotic (DZ) twin pairs. The STFS data used in the present analyses were drawn from mail responses of elementary school twin children who completed the P–H. From the 394 pairs of male, female and opposite-sex twins where both members returned the P–H, 9- to 12-year-old female twins were selected for the present analyses, resulting in 74 pairs of MZ and 42 pairs of DZ twins. Female pairs between 9 and 12 years of age were chosen as selecting only 11- and 12-year-old female pairs led to the very small numbers of twins for the STFS sample. Although the age range of the STFS sample does not match exactly with that of the MTFS sample, reliabilities of the self-concept scales were comparable between the MTFS and the STFS sample, as indicated in the Measure section. In addition, age only very modestly (–.06 to .06) influenced self-concept within the age range selected for the present study.

Measure

The P-H is a self-report instrument that assesses an evaluation of one's own behavior and attributes (Piers, 1976). The P–H includes 80 yes–no items written as simple declarative sentences, phrased positively or negatively. Twins in the STFS completed a South Korean version of the P–H translated by two bilinguals. According to the manual, the P–H has six cluster scales developed from factor analyses of the various samples.[1] The six cluster scales of the P–H are Behavior, Intellectual Competence and School Status, Physical Appearance and Attributes, Anxiety, Popularity, and Happiness and Satisfaction. These scales represent specific dimensions of the self that are commonly considered important among children. For each scale, higher scores indicate higher and more positive self-concept. The internal consistency reliabilities of the six cluster scales of the P–H as measured by Cronbach's alpha ranged from .68 to .79 with an average of .75 in the MTFS sample, and from .67 to .81 with an average of .74 in the STFS sample. Table 1 includes two sample items for each of the six cluster scales of the P–H.

As is the case with all self-concept measures (Wylie, 1989), the six cluster scales of the P–H displayed considerable negative skewness. Before behavioral genetic analyses, angular transformation of the raw scores (y = arcsine $\sqrt{p}$) of the six cluster scales was performed to approximate normal distributions.

Table 1
Two Sample Items for Each of the Six Cluster Scales of the Piers–Harris Children's Self-Concept Scale

Scale	Items
Popularity	I have many friends.
	I am unpopular.
Behavior	I cause trouble to my family.
	I get into a lot of fights.
Intellectual competence	I am a good reader.
and school status	I am an important member of my class.
Physical appearance	I am good looking.
and attributes	I have nice hair.
Anxiety	I am often sad.
	I worry a lot.
Happiness and satisfaction	I am a happy person.
	I am cheerful.

Table 2 presents correlations among the six cluster scales of the P–H in the two samples. The correlations were computed on the basis of the transformed scores. As indicated in Table 2, the interscale correlations were very similar across the two samples. Using Mx (Neale, 1999), the interscale correlations of the STFS were compared with the MTFS samples statistically. When the interscale correlations were constrained to be equal for the two samples, Mx yielded nonsignificant change in –2Log Likelihood (47.98 for 36 *df*), indicating that the scales behave similarly for the two samples.

Analytical Procedures

To compare genetic and environmental influences on various facets of self-concept between the STFS and MTFS samples, twin correlations were computed and univariate model-fitting analyses were conducted for each scale of the six cluster scales of the P–H. Mx (Neale, 1999) was used to carry out model-fitting analyses. Sources of variation considered in the full model were additive genetic variance (A), shared family environmental variance (C), and nonshared environmental variance including measurement error (E) for the STFS and the MTFS twins. Two steps were taken to compare the additive genetic, shared and nonshared environmental influences on self-concept between the MTFS and STFS samples. First, the most parsimonious model for each of the six cluster scales of the P–H was chosen for each sample. Second, parameter estimates in the most parsimonious models were compared between the MTFS and the STFS samples by constraining the additive genetic, shared environmental, and nonshared environmental variance

Table 2

Pearson Correlations Among the Six-Cluster Scales of the Piers–Harris Children's Self-Concept Scale in the MTFS and the STFS Sample

	Popularity	Physical	Anxiety	Happiness	Intellectual	Behavior
Popularity	—	.61	.60	.44	.54	.38
Physical	.59	—	.53	.59	.60	.39
Anxiety	.52	.44	—	.55	.60	.44
Happiness	.55	.66	.67	—	.52	.41
Intellectual	.56	.77	.48	.59	—	.54
Behavior	.33	.44	.49	.51	.58	—

Note: Correlations were computed on the basis of the transformed scores. Correlations for the STFS twins are below the diagonal; correlations for the MTFS twins are above the diagonal. All correlations are significant at $p < .01$. Physical = Physical Appearance and Attributes, Happiness = Happiness and Satisfaction, Intellectual = Intellectual Competence and School Status.

components to be equal in magnitude across the two samples. Chi-square difference tests and Akaike's Information Criterion (AIC; Akaike, 1987) that reflect both fit and parsimony were employed to choose the most parsimonious models within each sample and compare the parameter estimates between samples.

Results

Descriptive Statistics

Table 3 provides means and standard deviations of the P–H raw scores of the six cluster scales by zygosity in the MTFS and STFS samples. Levene's tests and *t* tests were conducted to compare means and standard deviations for the six cluster scales of the P–H between MZ and DZ twins in each sample and between samples within each zygosity group. As twins within a pair are not independent of each other, *t* tests and Levene's tests may yield slightly more significant *p* values by artificially inflating sample sizes.

In both zygosity groups, the means for the six cluster scales of the P–H in the MTFS sample were all significantly higher than those in the STFS sample with the exception of the Popularity scale. These results were generally consistent with the self-concept literature that demonstrated a higher self-concept in Americans than in East Asians, as previously discussed. In both zygosity groups, the standard deviations were significantly larger in the STFS when compared to the MTFS sample for four of the six cluster scales, that is, Physical Appearance and Attributes, Happiness and Satisfaction, Intellectual Competence and School Status, and Behavior.

In the STFS sample, six *t* tests yielded two significant mean differences for zygosity (Anxiety and Behavior), while six Levene's tests yielded only one significant variance difference for zygosity (Popularity). In the MTFS sample, means were significantly different between MZ and DZ twins for all of the six cluster scales, and variances were significantly different for four of the six cluster scales between the two zygosity groups.

Intraclass Correlations

Table 4 presents MZ and DZ twin intraclass correlations for the six cluster scales of the P–H for the MTFS and the STFS sample. Except for Happiness and Satisfaction in the STFS sample and Intellectual Competence and School Status in both samples, correlations for MZ twins were higher than those for DZ

Table 3

Means (Standard Deviations) for the Six Cluster Scales of the Piers–Harris Children's Self-Concept Scale in the MTFS and the STFS Scale

	MTFS		STFS	
Scale	MZ	DZ	MZ	DZ
Popularity	9.38 (2.39)	8.75 (2.68)	9.02 (2.33)	8.41 (2.70)
Physical	10.48 (2.37)	9.65 (2.82)	7.57 (3.31)	7.06 (3.48)
Anxiety	11.00 (2.83)	10.47 (2.99)	9.57 (2.77)	8.23 (3.11)
Happiness	9.20 (1.32)	8.72 (1.78)	7.84 (1.92)	7.51 (2.21)
Intellectual	14.57 (2.63)	14.11 (2.91)	10.73 (3.67)	10.82 (4.05)
Behavior	14.58 (1.79)	14.27 (2.21)	12.24 (2.47)	11.54 (2.69)

Note: MTFS = Minnesota Twin Family Study; STFS = Seoul Twin Family Study.
MZ = monozygotic twins; DZ = dizygotic twins.
Physical = Physical Appearance and Attributes; Happiness = Happiness and Satisfaction; Intellectual = Intellectual Competence and School Status.
See the text for the results of statistical significance tests.

Table 4

Twin Intraclass Correlations for the Six Cluster Scales of the Piers–Harris Children's Self-Concept in the MTFS and the STFS Sample

	MTFS		STFS	
Scale	MZ	DZ	MZ	DZ
Popularity	$.45^{**}$	$.44^{**}$	$.39^{**}$	$.35^{**}$
Physical	$.72^{**}$	$.48^{**}$	$.52^{**}$	$.37^{**}$
Anxiety	$.48^{**}$	$.43^{**}$	$.44^{**}$	$.38^{**}$
Happiness	$.50^{**}$	$.53^{**}$	$.31^{**}$	$.19^{*}$
Intellectual	$.72^{**}$	$.74^{**}$	$.39^{**}$	$.39^{**}$
Behavior	$.56^{**}$	$.28^{*}$	$.38^{**}$	$.30^{**}$

Note: MZ = monozygotic twins; DZ = dizygotic twins.
Physical = Physical Appearance and Attributes; Happiness = Happiness and Satisfaction; Intellectual = Intellectual Competence and School Status.
$^{*}p < .05$, $^{**}p < .01$.

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twins, suggesting the importance of genetic influences on self-concept. In both samples, however, correlations for DZ twins were generally higher than half the MZ correlations, indicating that shared environmental factors are also important in self-concept. MZ and DZ twin correlations in the MTFS sample were consistently lower than those in the STFS sample, suggesting that nonshared environmental influences and measurement errors are higher in the MTFS than in the STFS sample.

Model-Fitting Analyses

Selection of the Best-Fitting Model Within Each Sample

Table 5 presents the results of the univariate modeling for the MTFS and the STFS sample. The chi-square values for the full model indicated that the data did not depart significantly from the model except in the case of Happiness and Satisfaction in the MTFS sample. The reason for the relatively high chi-square value for Happiness and Satisfaction appeared to be the fact that the variances for this variable differed in MZ and DZ twins in the MTFS sample.

Three reduced models were tested to select the most parsimonious model for the six cluster scales of the P–H for each sample. The change in chi-square between the full model and reduced models was assessed when the additive genetic parameter was set to zero (CE), when the shared environment parameter was set to zero (AE), and when both additive genetic and shared environment parameters were set to zero (E). When both CE and AE models were acceptable based on the change in chi-square, the model with lower AIC was chosen for the most parsimonious model. On the basis of these criteria, the CE model fitted the data best for Popularity, Anxiety, and Intellectual Competence and School Status, while the AE model provided the most adequate fit for Physical Appearance and Attributes, and Behavior in both samples. The AE model was also the best for Happiness and Satisfaction in the STFS sample.

Comparison of the Relative Effects of Genetic and Environmental Factors in Self-Concept Between the MTFS and the STFS Sample

Using the parameters in the most parsimonious models for the six cluster scales of the P–H selected from each sample, full and reduced models were constructed to compare the relative effects of the genetic and environmental factors between the MTFS and the STFS samples. The full model allowed the parameters chosen from the most parsimonious model for each sample to vary between the two samples, while the reduced model constrained the parameters to be equal across the two samples. Differences in chi-square values between the full and reduced models for the six cluster scales of the P–H were obtained to determine whether the relative effects of additive genetic and environmental factors were comparable between the MTFS and the STFS samples. For example, on Physical Appearance and Attributes, because the AE model was chosen as the best-fitting model in both samples (Table 5), the full model allowed the A and E parameters to vary, while the reduced model constrained the A and E parameters to be equal across the two samples. Then, statistical significance of the difference in chi-square between the full and the reduced model was assessed. The results of the model-fitting for the six cluster scales of the P-H are provided in Table 6.

Table 5

The Results of Univariate Model-Fitting Analyses for the Six Cluster Scales of the Piers-Harris Children's Self-Concept Scale in the MTFS and the STFS Sample

		Model					
		Full		CE		AE	
Scale	Sample	$\chi^2_{(3)}$	AIC	$\Delta\chi^2_{(1)}$	AIC	$\Delta\chi^2_{(1)}$	AIC
Popularity	MTFS	1.09	–4.91	[**0.50**	**–6.41**]	2.97	–3.94
	STFS	1.90	–4.10	[**0.09**	**–1.91**]	1.87	–0.13
Physical	MTFS	1.71	–4.29	4.76*	–1.53	[**1.46**	**–4.83**]
	STFS	1.22	–4.78	6.43*	–0.35	[**0.63**	**–6.15**]
Anxiety	MTFS	1.25	–4.75	[**0.25**	**–6.50**]	4.31*	–2.45
	STFS	0.95	–5.05	[**0.34**	**–6.71**]	1.45	–5.59
Happiness	MTFS	10.25*	4.25	3.72	5.97	0	2.25
	STFS	2.58	–3.42	[**0**	**–5.42**]	3.76	–1.66
Intellectual	MTFS	1.35	–4.65	[**0.26**	**–6.39**]	4.33*	–2.33
	STFS	1.32	–4.68	[**0.03**	**–6.65**]	11.56**	4.88
Behavior	MTFS	6.27	0.27	3.15	1.42	[**0.48**	**–1.25**]
	STFS	5.15	–0.85	3.24	0.40	[**0.00**	**–2.84**]

Note: $\Delta\chi^2$ and *AIC* in the best-fitting model are highlighted in bold and bracketed. * $p < .05$, ** $p < .01$.
$\Delta\chi^2$ for *E* models were significant for all scales.
Physical = Physical Appearance and Attributes; Happiness = Happiness and Satisfaction; Intellectual = Intellectual Competence and School Status.
A = additive genetic variance; *C* = shared environmental variance; and *E* = nonshared environmental variance including measurement error.

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Table 6

Comparison of the Additive Genetic (*A*), Shared Environmental (*C*), and Nonshared Environmental (*E*) Variance Estimates for the Six Cluster Scales of the Piers–Harris Children's Self-Concept Scale in the MTFS and the STFS Sample

		% Variance (95% CI)			Model	
					Full	Reduced [a]
Scale	Sample	A	C	E	$\chi^2_{(8)}$	$\Delta\chi^2_{(2)}$
Popularity	MTFS	—	40(32, 47)	60(53, 68)	9.99	0.82
	STFS	—	40(32, 47)	60(53, 68)		
Physical	MTFS	54(45, 62)	—	46(38, 55)	5.40	6.47*
	STFS	73(61, 81)	—	27(19, 39)		
Anxiety	MTFS	—	43(39, 50)	57(50, 65)	2.79	0.24
	STFS	—	43(39, 50)	57(50, 65)		
Happiness	MTFS	—	26(16, 35)	74(65, 84)	16.55*	
	STFS	—	51(36, 63)	49(37, 64)		
Intellectual	MTFS	—	39(30, 48)	61(52, 70)	2.96	20.79**
	STFS	—	72(62, 80)	28(20, 38)		
Behavior	MTFS	46(37, 55)	—	54(45, 63)	11.91	1.37
	STFS	46(37, 55)	—	54(45, 63)		

Note: — fixed to be zero.
[a] The reduced model includes two constraints. Physical = Physical Appearance and Attributes; Happiness = Happiness and Satisfaction; Intellectual = Intellectual Competence and School Status.

When the parameters were equated across the two samples, significant changes in chi-square emerged for Physical Appearance and Attributes, and Intellectual Competence and School Status, indicating that the relative effects of the additive genetic and environmental factors on these scales are different between the two samples. Whereas additive genetic and nonshared environmental factors affected Physical Appearance and Attributes roughly equally in the MTFS sample (54% vs. 46%), additive genetic factors were much stronger than nonshared environmental factors in the STFS sample (74% vs. 26%). On Intellectual Competence and School Status, shared environmental influences were much larger than nonshared environmental influences in the STFS sample (71% vs. 29%), while the reverse was true in the MTFS sample (39% vs. 61%).

No significant change in chi-square occurred for Popularity, Anxiety and Behavior when the parameters were constrained, suggesting that the relative effects of the genetic and environmental factors are comparable between the two samples: nonshared environmental and shared environmental influences explained 57% and 43% for Anxiety and 60% and 40% for Popularity; and nonshared environment and additive genetic influences accounted for 54% and 46% for Behavior. For Happiness and Satisfaction, the fit was assessed when the full model incorporated C and E parameters and when the full model included A and E parameters in both samples. Neither of the full models, however, provided a good fit for the Happiness and Satisfaction scale, perhaps because the MTFS sample yielded a poor fit in the univariate analysis for this scale (see Table 5).

Discussion

Using the six cluster scales of the P–H, the present investigation compared contributions of the additive genetic and environmental factors to variations in six domains of self-concept between Minnesota and Seoul female preadolescent twins.

In both samples, a model incorporating shared and nonshared environmental influences fitted the data best for Popularity, Anxiety, and Intellectual Competence and School Status, whereas a model including additive genetic and nonshared environmental factors provided the best fit for Physical Appearance and Attributes, and Behavior. The univariate model did not yield an adequate fit for Happiness and Satisfaction. Estimates of additive genetic and environmental factors were significantly different between the two samples for Physical Appearance and Attributes (A = 54% for the MTFS and 73% for the STFS sample; E = 46% for the MTFS and 27% for the STFS sample) and Intellectual Competence and School Status (C = 39% for the MTFS and 72% for the STFS sample; E = 61% for the MTFS and 28% for the STFS sample). In contrast, the magnitudes of variance components were comparable between the two samples for Popularity (A = 40%, E = 60%), Anxiety (C = 43%, E = 57%), and Behavior (A = 47%, E = 54%).

It was interesting to note that the Intellectual Competence and School Status self-concept, presumably a correlate of intelligence, did not yield a significant heritability estimate either in the MTFS or STFS sample. Environmental factors alone could explain the Intellectual Competence and School Status self-concept in both samples. These results were in contrast with those found in Kuo et al.'s (2004) Chinese sample and in McGuire et al.'s (1999) Caucasian sample. In Kuo et al.'s study (2004), Chinese female adolescent twins yielded a heritability estimate of 43% and a shared environmental estimate of 23% for the CBCL School Competence scale, and McGuire et al. (1994) reported the corresponding estimates 61% and 0% for the Scholastic Competence scale of the Harter's Self-Perception Profile for Adolescents. The higher heritability estimates and the lower shared environmental estimates found in McGuire et al. and Kuo et al.'s samples might be due in part to the fact that the twins in both studies were older (10 to 18 years for the former and 12 to 16 years for the latter) than the twins in the present study. Another possible reason for the discrepancies in estimates might be that items of the P–H Intellectual Competence and School Status scale tap the intellectual aspect of the self generally, whereas the items of the School Competence scale in Kuo et al.'s study and those of the Scholastic Competence scale in McGuire et al.'s study inquire about one's school performance records specifically.

It was notable that for variations in the Intellectual Competence and School Status scale, shared family environmental factors were much more important than nonshared environmental factors in the STFS sample, whereas the reverse was true in the MTFS sample. These findings imply that family SES, parental enthusiasm and pressure on children for better scholastic performance prevalent in South Korean society heavily influence individual differences in the intellectual and school self-concept among preadolescent girls in South Korea. In contrast, in the United States children's unique individual experiences rather than parental factors may largely determine individual differences in the Intellectual Competence and School Status self-concept.

Regarding Physical Appearance and Attributes, heritability was significantly higher and nonshared environmental factors were lower in the STFS than in the MTFS sample, suggesting that in determining the physical domain of self-concept, genetic factors are more important among preadolescent girls in Seoul, whereas individual environmental factors are more important in Minnesota. Given that physical attributes are highly heritable traits, these findings suggest that preadolescent girls in Seoul may be more realistic than their Minnesota peers in evaluating their physical appearance.

Significant shared environmental effects were detected for the Anxiety self-concept in both samples in the present study. This result agrees strongly with previous findings of large family environmental influences on anxiety and depression symptoms in preadolescent Caucasian twins (Eley & Stevenson, 1999; Rice, van den Bree, & Thapar, 2004). Significant shared environmental influences were also found for Popularity in both samples. This finding was consistent with the shared environment estimates found for the Social Competence scale of the CBCL in a Chinese twin sample (Kuo et al., 2004) and a Caucasian twin sample (Edelbrock et al., 1994), but much higher than those (0% at time 1 and 9% at time 2) found for a similar scale from McGuire et al.'s Caucasian sample. More twin studies of self-concept are needed to resolve the contradictory findings on the popularity self-concept.

In the present study, standard deviations for self-concept scales were generally larger in the STFS than in the MTFS sample. The larger standard deviations in the STFS sample do not appear to be due to the fact that the age range of the twins in the STFS was slightly larger than that of the MTFS sample, as the same differences in standard deviations were observed when the scores of only 11- and 12-year-old females from the STFS sample were compared with those of the MTFS sample.[2] There may be more divergent views of self in South Korean society than in American society. As traditional and western cultures exist together in South Korean society, some in this society would hold traditional conception of self, whereas others, due to an increasing impact of western cultures, may support and adapt to a western concept of self, which would increases variances of different self-concept dimensions in South Korean society.

Although means of the six P–H cluster scales for Seoul preadolescent girls were consistently lower than those for Minnesota preadolescent girls, there was no uniform relationship between mean differences and differences in the genetic and environmental estimates between the two samples across the six scales. Refined analyses in the future would reveal whether differences in means for various self-concept dimensions between the two countries are due to different allele frequencies, varying genotypic values, different social values and/or different processes of genotype–environment interaction for the self-concept development in the two countries.

The present study has three potentially significant limitations. First, although an attempt has been made to reduce measurement error by using the same instrument, the self-concept measure employed in the present study was developed in the United States, which may not adequately cover cultural differences between American and South Korean societies. Second, the sample size of the STFS in the present study was small and thus may not have provided sufficient power to detect differences in genetic and environmental influences on the six domains of self-concept between the STFS and the MTFS samples. Replications with larger samples would be necessary. Finally, given the gender, age and ethnic differences in self-concept reported elsewhere (e.g., Damon & Hart, 1982; Gray-Little & Hafdahl, 2000), it is emphasized that the present findings can only be generalizable to preadolescent females in Minnesota and Seoul.

Endnotes

1 The items of the original six factorially derived cluster scales have been revised (Piers, 1976). In the present analyses the six revised cluster scales were used.

2 Data are available upon request to the author.

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