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ABSTRACT

Mathematical performance of young Chinese children in Taiwan as compared to American children beginning as early as first grade has been well-documented. A similar study by Huntsinger, et al, 1995, demonstrated the same phenomenon in comparisons of Chinese-American young children with Euro-American children. Parents influence young children's developing competence by the experiences they provide and the activities they choose for their children, and cultural belief systems influence parents' ideas concerning the relative importance of activities. This study is a longitudinal comparison of 36 second-generation Chinese-American children and 40 Euro-American young children (from well-educated families in the suburban Chicago are) in their family environments, providing a synopsis of the data collected in 1995 when the children were in first and second grades. The data were collected in order to: (1) investigate whether the Chinese-American early mathematics advantage is maintained after children are exposed to formal mathematics teaching in first grade; (2) further identify differences in the early socialization practices of parents in the two cultural groups; and (3) examine relationships between mathematics achievement, parental socialization practices, and perceptions of children's competence. A total of 36 second-generation Chinese-Americans from Chicago suburbs participated in this second phase of data collection, including 95 percent from the first phase (1993). Each child was given the Sequential Assessment of Mathematics Inventories (SAMI) and other assessments. According to the results, Chinese-American children continued to demonstrate higher mathematics performance in Phase 2. Parents provided different experiences for their young children, who reflected different parental values and appeared to foster different competencies. Contains 7 tables of data and 14 references. (BGC)

Running head: CULTURE AND EARLY MATH

Different Cultures, Different Competencies: A Comparison of Chinese-American and Euro-American First and Second Grade Children

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Different Cultures, Different Competencies: A Comparison of Chinese-American and Euro-American First and Second Grade Children

The superior mathematics performance of Chinese children in Taiwan as compared to American children beginning as early as first grade has been well-documented (e.g., Stevenson, Lee, & Graham, 1993). A study by the present authors (Huntsinger, Jose, Liaw, & Ching, 1995) has demonstrated the same phenomenon in comparisons of Chinese-American young children with Euro-American young children. Because both groups of children in the Huntsinger et al. study were attending similar preschools and kindergartens in the United States, the early performance difference was attributed to differences in parental beliefs and practices, rather than to differences in school curricula.

Parents influence young children's developing competence by the experiences they provide and the activities they choose for their children (Eccles, 1993). Cultural belief systems influence parents' ideas concerning the relative importance of providing various activities (Huntsinger et al., 1995). Ethnicity differences in activity participation have been found in comparisons of older Chinese-American and Euro-American children. In particular, Chinese-American eighth graders were more likely to take private music lessons and to attend language schools, and less likely to participate on sports teams and to do household chores than their Euro-American counterparts (Schneider, Hieshima, Lee, & Plank, 1994).

It stands to reason that the amount of practice and experience in a given domain will influence children's acquisition of knowledge and skill in that domain. There are, however, few formal studies of children's use of time. Recent research into the time allocation of young children has focused on gender differences, finding that boys spend more time in sports and computer activities, while girls spend more time in reading (Eccles, 1993; Huston, Wright, Murphy, & Oppenheimer, 1993). Are the same kinds of differences evident in time use across cultures? In a recent cross-national study of adolescent time use, Fuglini and Stevenson (1995) found that Chinese high school students in Taiwan spent significantly more time in academic pursuits, while American students spent more time working and socializing with friends. Furthermore, the cultural

differences in use of time were related to mathematics achievement. Does this phenomenon hold true for different ethnicities in the same country? If so, how early does this socialization process begin?

Does the parents' provision of different activities for their young children influence the children's self-perceptions of domain-specific competence and the teachers' perceptions of the children's competence? It would seem that more experience in a particular domain would increase a child's self-perception of competence in that domain. Teachers may also rate a child with greater experience in a particular domain as more competent in that domain.

To investigate these questions, we are conducting a longitudinal comparison of Chinese-American and Euro-American young children in their family environments. This paper provides a snapshot of the Time 2 data, collected in 1995 when the children were in first and second grades. There is the general belief in the United States that school is the great leveler--that when all children are exposed to the formal teaching of the primary grades, early performance differences will "wash out" over time.

The data reported here were collected: (1) to investigate whether the early Chinese-American mathematics advantage (from Time 1) is maintained after all children are exposed to formal mathematics teaching in first grade, (2) to further identify differences in the early socialization practices of parents in the two cultural groups, and (3) to examine the relationship between mathematics achievement, parental socialization practices, and perceptions of the child's competence.

Method

Subjects

Thirty-six second-generation Chinese-American children (16 first-graders; 20 second-graders) and forty Euro-American children (20 first graders; 20 second graders) from well-educated families in the suburban Chicago area participated in this second wave of data collection (1995). Ninety-five percent of the children from the Time 1 (1993) sample were included; three of the original Chinese-American families had moved back to Taiwan or Hong Kong and the fourth

declined participation. Because all four missing subjects were from the first-grade group, grade level was covaried out in the achievement comparisons. (See Table 1 for sample characteristics and Huntsinger et al. (1995) for a thorough discussion of the samples.)

Materials

Sequential Assessment of Mathematics Inventories (SAMI) (Reisman & Hutchinson, 1985) measures the performance of children from kindergarten to eighth grade in eight strands of mathematics: mathematical language, ordinality, number and notation, computation, measurement, geometric concepts, mathematical applications, and word problems. Individual administration takes from 20 to 60 minutes per child. The mathematical applications subtest, designed for students in 4th – 8th grades, was not given.

Visual-Motor Control Subtest from the Bruininks-Oseretsky Test of Motor Proficiency (Bruininks, 1978). The visual-motor control subtest (all but item #1) was individually administered during the second testing session in the child's home.

Digit Span and Spatial Relations Tests from the Michigan Cognitive Battery. The digit span and spatial relations tests from the Michigan Cognitive Battery (Stevenson, Lee, Chen, Stigler, Hsu, & Kitamura, 1990) were administered to the children to measure two additional math-related cognitive ability areas.

Pictorial Scale of Perceived Competence and Social Acceptance for Young Children. This individually administered measure by Harter and Pike (1981) for preschool and primary children contains four six-item subscales: cognitive competence, physical competence, peer acceptance, and maternal acceptance. A child looks at 24 pairs of pictures of a more competent (or more accepted) child and a less competent (or less accepted) child and indicates which is more like her/him and how much the designated picture is like him/her. In this paper we looked at two scales: cognitive and physical competence.

Teacher's Rating Scale of the Child's Actual Competence and Social Acceptance (Harter & Pike, 1983) contains eighteen items in three subscales, corresponding to the cognitive competence,

physical competence, and peer acceptance items in the children's measure. Items are rated using a 4-point scale.

Parent Questionnaire. Fathers and mothers individually completed questionnaires regarding their child's homework and participation in activities outside of school.

Parent Interviews. Mothers and fathers were interviewed as couples in their homes. Three items from the parent interviews are used in this paper. (1) Diaries of their children's time use were obtained from parents during the interview. Parents were asked to describe in detail their child's typical weekday, beginning when their child awakened in the morning and ending when their child went to bed at night. They were also asked to describe their child's typical Saturday and Sunday in the Spring. From that, the following variables were calculated: daily time awake, free time, homework time, reading time, music practice, sports practice, television time, Chinese School homework time, and time spent in weekend Chinese school, organized sports, music lessons, and religious services. (2) "Does your child have any regular household chores to perform? If so, what are the particular chores s/he is expected to do?" [Responses were grouped into the categories of setting/clearing table, laundry, furniture care, pet care, plant care, picking up/cleaning, garbage, food preparation, watching sibling, yard work.] (3) "How do you facilitate your child's development in math?" Each of the separate methods parents mentioned was rated on a scale of 1 (simple, concrete, play-oriented) to 3 (complex, abstract, work-oriented) and a mean simple-complex index was derived for each family. (See Table 5 for examples of methods.)

Procedure

Each child was given the Sequential Assessment of Mathematics Inventories (SAMI) and the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children in a testing session at her/his school. The digit span and spatial relations tests from the Michigan Cognitive Battery and the visual-motor control subtest from the Bruininks-Oseretsky Test of Motor Proficiency were administered in a second testing session at their home. Mothers and fathers independently completed questionnaires which surveyed children's activity participation and homework. In addition, parents were interviewed as couples regarding their child's use of time,

their child's household chores, and their facilitation of mathematics. Finally, the children's teachers were asked to complete the Teacher's Rating Scale of Child's Actual Competence and Social Acceptance.

Results

Mathematics Achievement

Two (ethnicity) x 2 (sex of child) ANOVAS with grade level as a covariate revealed that Chinese-American children scored higher in mathematics, completed the spatial relations test in a significantly shorter time, and outperformed the Euro-American children on the visual-motor test. (See Table 2.) Chinese-American children outscored Euro-American children on two mathematics subtests that are often the subject of comparison: computation and word problems. No group differences were found for the spatial relations and digit span tests from the Michigan Cognitive Battery.

Competence Ratings

Teachers' ratings of children's cognitive competence were higher for Chinese-American children than for Euro-American children. No differences were found on teachers' ratings for physical competence. The two groups of children rated themselves similarily on cognitive competence; however, Chinese-American children rated themselves lower on physical competence than did Euro-American children.

Allocation of Time

A MANOVA performed on data from the time diaries indicated an enormous ethnicity difference in the children's daily and weekly use of time, $F(12, 61) = 37.39$, $p > .0001$. (See Table 4). Chinese-American children were awake for more hours per day; had less free time; spent more time in academic homework, music practice, and Chinese homework; and less time in organized sports than their Euro-American counterparts. Because first and second grade teachers gave children very little mathematics homework, 65% of Chinese-American parents and 15% pf Euro-American parents assigned their children additional mathematics homework. Chinese-American parents (23 of 36) were as likely as Euro-American parents (27 of 40) to mention playing

with friends in their time use diaries. Chinese-American children played with friends primarily on weekends, whereas Euro-American children played with friends on weekdays and weekends. Chinese-American parents appear to reserve school days for focusing on the development of academic and music skills through structured practice and self-discipline.

Euro-American parents ($M = 2.5$) expected their children to perform more household chores than did Chinese-American parents ($M = 1.5$). Specifically, more Euro-American children than Chinese-American children were expected to help with laundry (Ns = 13, 4), pet care (Ns = 8, 0), picking up/cleaning (Ns = 35, 22), and garbage (Ns = 11, 4), X^2s (1) = 4.99, 8.04, 7.04, 3.21, ps < .05, .01, .01, .07, respectively.

Parents' Mathematics Facilitation

An examination of the methods parents reported using to facilitate mathematics development in their children shows that Euro-American parents tended to use methods embedded in context (e.g., real-life situations and games). (Refer to Table 5.) Chinese-American parents, on the other hand, were more likely to emphasize memorization of math facts, to buy additional teaching materials, and to introduce mathematics beyond the child's grade level. The Chinese-American parents provided a more systematic approach, whereas the Euro-American parents' approach was more incidental. When the parental mathematics facilitation methods were rated on a continuum from simple (1) to complex (3), ethnicity differences emerged. A 2 (ethnicity) x 2 (sex of child) ANOVA revealed the mean for Chinese-American parents was 2.37, while the mean for the Euro-American parents was 1.74, F (1,72) = 27.73, $p < .0001$. Chinese-American parents tended to use more complex methods than Euro-American parents when teaching their children.

Regression Analyses

Two sets of forced-entry, hierarchical regression analyses on three measures of mathematics achievement (SAMI score, computation, and word problems) were performed. Entries in the regression analyses included variables that had differentiated between the two groups in the ANOVAs and that were correlated with the mathematics scores. The purpose of these regression analyses was to see whether the factors we have discussed could account for the

differences in the levels of mathematics achievement between groups. In the first set of regressions mathematics facilitation methods, amount of time spent on homework, teacher's rating of the child's cognitive competence, and ethnicity were entered in that order on each of the dependent variables. Ethnicity was coded as 0 = Chinese-American and 1 = Euro-American. The distal variable of ethnicity was included last because it could have hidden the contribution of other important proximal factors, if entered first. Mathematics facilitation methods, time spent on homework, amd teacher's rating of the child's cognitive competence all contributed unique variance to the total SAMI score, the computation score, and the word problem score, while ethnicity did not emerge as a predictor. (See Table 6). Children whose parents used more complex, systematic mathematics teaching methods had higher scores on the mathematics achievement measures. Children who spent more time doing homework had higher mathematics scores. Children whose teachers rated them as more cognitively competent had higher mathematics scores.

Another set of regressions was performed entering the distal variable of ethnicity first, the teacher's rating of the child's academic competence second, and the two proximal variables, mathematics facilitation methods and time spent on homework third. Examination of the results in Table 7 shows that the initial unique variance accounted for by ethnicity becomes insignificant when the other variables are entered. Beta weights from the final equation reveal that ethnicity by itself directly contributes almost nothing. The parental teaching and guidance of their child in homework appear to be more important in the children's mastery of mathematics than is the global variable of ethnicity. When the child has a higher mastery of mathematics, the child's teacher rates him/her as more cognitively competent.

Discussion

Chinese-American children in early primary school continued to demonstrate higher mathematics performance than Euro-American children at Time 2. Parents in the two ethnicities provided different experiences for their young children, which reflected different parental values and appeared to foster different competencies in their children.

Chinese-American parents provided more complex mathematics teaching for their children and reported that their children spent more time doing homework. Both variables were associated with higher mathematics performance. Regarding cognitive competence, teachers rated Chinese-American children as significantly more competent than Euro-American children, although the two groups of children rated themselves as equally competent. Teachers were in a good position to estimate children's academic performance because they had observed these particular children for approximately eight months and had worked with many children over the years. It is possible that a cultural factor may be affecting the children's self-ratings: the tendency toward self-effacement among Chinese people. Chinese people (children and adults) tend to rate themselves more modestly (Chen, Lee, & Stevenson 1995; Stigler, Smith, & Mao, 1985) than do Euro-American people.

On the other hand, Euro-American parents provided their children with greater experience in team sports. It would seem that more time spent in sports practice should increase children's actual physical competence. However, teachers' ratings of children's physical competence did not reflect an ethnicity difference. Several of the teachers commented that they had not observed the children during gym and outdoor recess and therefore were less sure of their ratings. We did not use a direct assessment of children's gross motor development in this Time 2 data collection, however, so we cannot say whether teachers' ratings represented children's actual physical competence. The fact that Chinese-American children's self-ratings of their physical competence were significantly lower than those of their Euro-American counterparts may indicate that they feel less competent in sports. We learned from our Time 1 data that Chinese-American parents tended to discourage rough-and-tumble play (Jose, Huntsinger, & Huntsinger, 1995).

A connection between mathematics achievement and time spent on homework has not consistently been found in previous studies (Chen & Stevenson, 1989). In those studies, students were asked to estimate how much time per week they spent on homework. In this study parents were asked to give a description of a typical school day for their child. This time use diary method

may give a more accurate picture. Parents may be better sources than children for this kind of information.

Our data indicate that the ethnicity differences in activity participation of eighth graders noted by Schneider et al. (1994) have their beginnings very early. In our first and second graders, Chinese-American children were much more likely to take music lessons and to attend language schools, while Euro-American children were more likely to participate in team sports and to be expected to do household chores.

Our group comparisons demonstrate that different cultures in the United States have different ideas about what competencies to nurture in their children and how to nurture those competencies. Our regressions indicate that it is not ethnicity per se, but rather the practices of the parents that influence a child's mathematics competence in the early years. Although our Time 1 questionnaire data indicated that both Euro-American parents and Chinese-American parents rated mathematics competence as very important to develop in their child, our Time 2 data indicate that the Euro-American parents invest more of their young child's time in developing competence in sports. The United States has been looking for explanations for the relatively poor mathematics performance of its school children. Chinese-American families may be a good place to look for ideas and suggestions to improve children's mathematics performance. The success of their children is no accident!

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Table 1

Sample Demographics

	Chinese-American		Euro-American	
	Mean	S.D.	Mean	S.D.
Mean age of child	7.75	.34	7.70	.32
Number of boys in sample	18		20	
Number of girls in sample	18		20	
Number of children in family	2.21	.55	2.41	.71
Mother's mean age	39.38	2.88	38.88	4.40
Father's mean age	41.77	3.09	41.62	4.84
Mother's mean educational attainment	16.73	1.94	17.18	1.32
Father's mean educational attainment	18.23	2.21	17.68	1.81
Hollingshead status score mean	59.83	6.81	60.77	4.63

Table 2

Ethnicity Differences in Children's Measures

	Chinese-Am. Mean	Euro-Am. Mean	F	p
SAMI Total Mathematics Raw Score	82.75	70.03	13.60	.0001
Computation	19.88	13.40	24.95	.0001
Word problems	5.61	4.60	4.98	.029
Spatial relations test (Michigan Cognitive Battery)	11.63	11.08	1.57	NS
Minutes required to complete spatial relations test	1.62	1.93	7.46	.008
Digit span test (Michigan Cognitive Battery)	7.77	7.72	.13	NS
Visual motor control test (Bruininks-Oseretsky)	18.02	16.17	12.57	.001
Time on mathematics homework (min./day)	20.59	4.73	28.29	.0001
Child's cognitive competence (teacher rating)	3.80	3.38	12.89	.001
Child's physical competence (teacher rating)	3.30	3.30	.00	NS
Child cognitive competence (child rating)	3.54	3.57	.14	NS
Child physical competence (child rating)	3.16	3.55	13.40	.0001

Table 3

Ethnicity Differences in Activity Participation

	Chinese-Am. Frequency	Euro-Am. Frequency	X^2	p
Soccer	5	19	10.43	.001
Baseball	3	15	9.32	.002
Swimming lessons	28	33	.58	NS
Piano lessons	28	5	32.05	.0001
Violin lessons	10	0	12.50	.001
Dance class	11	12	.06	NS
Indian Guides/Princesses	0	10	10.65	.001
Day camp	14	21	3.10	NS
Religious education	13	27	8.25	.004
Weekend Chinese school	34	0	67.38	.0001
Attended professional sports event	7	28	24.72	.0001
Attended orchestra concert	21	14	1.68	NS
Visited art museum	30	19	7.54	.006
Has taken a long automobile trip	30	31	.49	NS
Traveled outside U.S.A.	33	11	27.26	.0001

Table 4

Ethnicity Differences in Parents' Reports of Children's Time Use

	Chinese-Am. Mean	Euro-Am. Mean	F	p
Daily time use per schoolday				
Hours spent awake	14.33	13.61	23.45	.0001
Free time in hours	2.61	3.38	9.13	.003
Homework (minutes)	30.89	10.60	22.02	.0001
Music practice (minutes)	27.03	3.75	26.73	.0001
Organized sports practice (minutes)	7.10	20.07	9.70	.003
Reading (minutes)	29.86	23.87	3.06	NS
Watching television (minutes)	40.80	44.50	.20	NS
Weekly Time				
Chinese school homework (hours)	1.36	.00	65.35	.0001
Sports competitions (hours)	.30	1.23	22.09	.0001
Music lessons (hours)	.74	.07	33.74	.0001
Religious services (hours)	.85	1.07	.97	NS
Weekend Chinese school (hours)	2.66	.00	207.69	.0001

Table 5

Ethnicity Differences in Parents' Reports of Mathematics Facilitation Methods

	Chinese-Am. Frequency	Euro-Am. Frequency	X^2	p
Parent states, "No flashcards or drill."	0	5	4.82	.05
Teach through play (e.g., playing store)	2	4	.51	NS
Real-life situations (e.g., counting his allowance)	3	28	29.83	.0000
Card games, board games	2	10	5.39	.05
Computer programs	4	14	5.98	.05
Help with counting	1	7	4.36	.05
Give more practice with problems at grade level	15	14	.36	NS
Emphasize the memorization of math facts	7	0	8.57	.01
Older sibling teaches younger child	6	0	7.23	.01
Give challenging math problems while driving	4	5	.03	NS
Provide additional math teaching materials	20	10	7.40	.01
Takes mental math or abacus in Chinese School	5	0	5.95	.05
Systematic preteaching of higher level material	17	5	11.11	.001

Table 6

Prediction of Mathematics Outcomes from Parents' Mathematics Methods, Homework Time, Teacher Ratings of Competence, and Ethnicity

Child Outcome Measures	Predictors	R^2 Change	Total R^2	B (SE B)	ß
SAMI Raw Score	Parents' math methods	.14***	.14	7.53 (3.79)	.24*
	Time on homework	.07*	.21	.25 (0.10)	.27*
	Teacher rating/ child's cognitive competence	.09**	.30	12.12 (4.14)	.32**
	Ethnicity	.00	.30	1.90 (5.15)	.05
Computation Score	Parents' math methods	.16***	.16	2.40 (1.37)	.19
	Time on homework	.13***	.29	.12 (0.04)	.33**
	Teacher rating/ child's cognitive competence	.10**	.39	4.51 (1.49)	.31**
	Ethnicity	.00	.39	- .80 (1.85)	-.05
Word Problems Score	Parents' math methods	.06*	.06	.43 (0.44)	.12
	Time on homework	.07*	.13	.03 (0.01)	.27*
	Teacher rating/ child's cognitive competence	.09**	.22	1.39 (0.48)	.33**
	Ethnicity	.00	.22	.36 (0.60)	.08

Notes. Chinese-American was coded as 0; Euro-American was coded as 1. Unstandardized coefficients (and standard errors) and Betas are from the final regression equation; R^2 change and R^2s are from the step at which the particular variable entered the equation.

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

Table 7

Prediction of Mathematics Outcomes from Ethnicity, Teacher Ratings of Competence, Parents' Mathematics Methods, and Homework Time

Child Outcome Measures	Predictors	R^2 Change	Total R^2	B (SEB	ß
SAMI Raw Score	Ethnicity	.11**	.11	1.90 (5.15)	.05
	Teacher's rating/ child cognitive competence	.08**	.19	12.12 (4.14)	.32**
	Parents' math methods	.05*	.24	7.53 (3.79)	.24*
	Time on homework	.06*	.30	.25 (0.10)	.27*
Computation Score	Ethnicity	.19***	.19	- .80 (1.85)	- .05
	Teacher's rating/ child's cognitive competence	.07**	.26	4.51 (1.49)	.31**
	Parents' math methods	.04*	.30	2.40 (1.37)	.19
	Time on homework	.08**	.39	.12 (0.04)	.33**
Word Problems Score	Ethnicity	.06*	.06	.37 (0.60)	.08
	Teacher's rating/ child's cognitive competence	.08**	.14	1.39 (0.48)	.33**
	Parents' math methods	.02	.16	.43 (0.44)	.12
	Time on homework	.06*	.22	. 03 (0.01)	.27*

Notes. Chinese-American was coded as 0; Euro-American was coded as 1. Unstandardized coefficients (and standard errors) and Betas are from the final regression equation; R^2 change and R^2s are from the step at which the particular variable entered the equation.

*p < .05.
**p <. 01.
***p < .001.

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	Date: June 29, 1996

Fourteenth Biennial Conference on Human Development
(Birmingham, AL, March 29-31, 1996).

OVER

University of Illinois
at Urbana-Champaign

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March 26, 1996

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Karen E. Smith
Acquisitions Coordinator